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**STATE OF HAWAII**
**DEPARTMENT OF HEALTH**
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HONOLULU, HI 96801-3378

**07049PCWB.18a**
**DATE: July 27, 2018**
**NPDES PERMIT NO. HI 0020117**

**FACT SHEET: MAJOR MODIFICATION TO THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT AND ZONE OF MIXING (ZOM) TO DISCHARGE TO MAMALA BAY, PACIFIC OCEAN, WATERS OF THE UNITED STATES**

**PERMITTEE: CITY AND COUNTY OF HONOLULU**

**FACILITY: SAND ISLAND WASTEWATER TREATMENT PLANT**

**FACILITY MAILING ADDRESS**
City and County of Honolulu
Sand Island Wastewater Treatment Plant
1000 Uluohia Street, Suite 308
Kapolei, Hawaii 96707

**FACILITY STREET ADDRESS**
City and County of Honolulu
Sand Island Wastewater Treatment Plant
1350 Sand Island Parkway
Honolulu, Hawaii 96819

**PERMITTEE MAILING ADDRESS**
City and County of Honolulu
1000 Uluohia Street
Kapolei, Hawaii 96707
Contact: Ms. Lori Kahikina, Director
Dept. of Environmental Services
City and County of Honolulu
(808) 768-3486

## Table of Contents

This Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of the modified permit.

## A. Permit Information

The following table summarizes administrative information related to the Sand Island Wastewater Treatment Plant (hereinafter, facility).

**Table F-1. Facility Information**

| | |
|---|---|
| **Permittee** | City and County of Honolulu |
| **Name of Facility** | Sand Island Wastewater Treatment Plant |
| **Facility Address** | 1350 Sand Island Parkway<br>Honolulu, HI 96719 |
| **Facility Contact, Title, and Phone** | Lori M.K. Kahikina, Director, (808) 768-8481 |
| **Authorized Person to Sign and Submit Reports** | Lori M.K. Kahikina, Director, (808) 768-8481 |
| **Mailing Address** | 1000 Ulouhia St, Suite 308<br>Kapolei, HI 96707 |
| **Billing Address** | Same as above |
| **Type of Facility** | Wastewater Treatment Plant |
| **Pretreatment Program** | Yes |
| **Reclamation Requirements** | No |
| **Facility Design Flow** | 90 million gallons per day (MGD) |
| **Receiving Waters** | Mamala Bay, Pacific Ocean |
| **Receiving Water Type** | Marine |
| **Receiving Water Classification** | Class A Wet Open Coastal Waters<br>(HAR, Section 11-54-06(b)(2)(B)) |

**1.** NPDES Permit No. HI 0020117 for the Sand Island Wastewater Treatment Plant (“SIWWTP” or “facility”), including ZOM, became effective on November 2, 1998, and expired on November 3, 2003, (the “Prior Permit”). The Permittee submitted an application for continued 301(h) variance on May 5, 2003. The Permittee reapplied for an NPDES permit and ZOM on December 21, 2010, with additional information submitted on May 16, 2011, September 16, 2011, March 14, 2012, March 23, 2012, April 3, 2012, and June 19, 2013. The NPDES Permit and ZOM were reissued on November 12, 2014, with an effective date of January 1, 2015, and is set to expire on November 11, 2019. Since its issuance, the permit underwent two modifications on December 23, 2014 and September 10, 2015 (“2014 Permit”).

**2.** On December 12, 2014, the Permittee filed a request for a contested case hearing (Docket No. 15-CWB-EMD-3) objecting to several conditions of the 2014 Permit. On April 16, 2015, the Department of Health (DOH), Clean Water Branch (CWB) entered into a stipulated order with the Permittee to stay a number of the contested permit conditions until a final decision was made in the contested case hearing.

**3.** On May 19, 2017, the DOH and the Permittee reached an agreement on certain contested items and entered into a Third Stipulation, which was approved by the

Hearings Officer ("Stipulated Order"). On June 30, 2017, the Permittee provided a new dilution study (dated June 29, 2017). On May 1, 2018, the 2014 Permit was reopened and modifications proposed consistent with the Stipulated Order. This fact sheet and modified permit incorporate those revisions.

**4.** The major modification of the 2014 Permit is authorized under Hawaii Administrative Rules ("HAR"), Section 11-55-16; and 40 CFR Section 122.62(a)(2) and 40 CFR Section 122.62(a)(15). In accordance with 40 CFR Section 124.5(c)(2), only the modification of certain conditions are being reopened as follows:

1) Removing the DDT maximum daily and average annual effluent limitations and revising the monitoring frequency from monthly to semi-annually pursuant to 40 CFR Section 122.62(a)(15) (specifically, excluding non-detects from RPA calculations);

2) Removing the chlordane maximum daily and average annual effluent limitations pursuant to 40 CFR Sections 122.62(a)(2) (specifically, consideration of additional data and new dilution study) and (a)(15) (specifically, (1) utilizing an RPA that projected daily maximum concentrations, thereby not considering the long exposure time associated with human health criteria for carcinogens (e.g. 70 years) and the fact that human health criteria for carcinogens is expressed as an annual average and (2) the treatment of non-detects in RPA calculations);

3) Revising the dieldrin maximum daily and average annual effluent limitations pursuant to 40 CFR Sections 122.62(a)(2) (specifically, consideration of additional data and new dilution study) and (a)(15) (specifically, (1) utilizing an RPA that projected daily maximum concentrations, thereby not considering the long exposure time associated with human health criteria for carcinogens (e.g. 70 years) and the fact that human health criteria for carcinogens is expressed as an annual average and (2) the treatment of non-detects in RPA calculations);

4) Removing the ammonia nitrogen maximum daily effluent limitations pursuant to 40 CFR Sections 122.62(a)(2) (specifically, utilization of additional data) and (a)(15) (specifically, the treatment of non-detects in RPA calculations);

5) Revising the enterococcus maximum daily and average monthly effluent limitations pursuant to 40 CFR Section 122.62(a)(2) (specifically, consideration of additional data and new dilution study);

6) Revising certain Whole Effluent Toxicity ("WET") requirements, including for the Instream Waste Concentration ("IWC") and test species pursuant to 40 CFR Section 122.62(a)(2) (specifically, consideration of additional information regarding projected changes to the treatment train and species sensitivities, and new dilution study); and

7) Removing Part I.5 of the 2014 Permit, "Planned Changes" pursuant to 40 CFR Section 122.62(a)(15) (specifically, to achieve consistency with 40 CFR 122.41(l)).

The expiration of the modified permit shall remain as November 11, 2019.

**5.** The Director of Health (Director) has included in the modified permit those terms and conditions which are necessary to carry out the provisions of the Federal Water Pollution Control Act (P.L. 92-500), Federal Clean Water Act (CWA) (P.L. 95-217) and Chapter 342D, Hawaii Revised Statutes.

## B. Facility Setting

### 1. Facility Operation and Location

The Permittee owns and operates the facility, located in Honolulu, Hawaii, on the island of Oahu. The facility has an average design flow of 90 MGD and provides primary treatment of wastewater for approximately 460,000 people in the Sand Island Basin. Influent wastewater enters the facility and is distributed to a minimum of two (2) of six (6) available aerated screening channels, where screening and flow measurement using Parshall flumes occur. From there, wastewater is directed to the clarifiers' influent channels for primary treatment. The clarifiers' influent channels distribute wastewater to eight 150-foot diameter primary clarifiers. At normal flow, four clarifiers are in use. Primary treated wastewater is then piped to effluent screens and then to disinfection. The facility contains five (5) available dual bank medium pressure ultraviolet (UV) disinfection channels. After disinfection, treated effluent is discharged to Mamala Bay, Pacific Ocean, through Outfall Serial No. 001, at Latitude 21°17'01"N and Longitude 157°54'24"W.

Outfall Serial No. 001 is an 84-inch diameter deep ocean outfall that discharges treated effluent through a diffuser that starts approximately 9,100 feet offshore and 230 feet below the surface of the water. The diffuser is approximately 3,400 feet long with 282 side ports that range in size from three (3) inches to 3.53 inches in diameter and two 7-inch diameter ports in the end gate.

Sludge processing at the facility consists of gravity thickeners, wet sludge storage tanks, and a digester. Biosolids are processed onsite by an independent contractor.

Storm water from the facility is regulated under the City and County of Honolulu's municipal separate storm sewer (MS4) permit, NPDES Permit No. HIS000002.

Figure 1 of the modified permit provides a map showing the location of the facility. Figure 2 of the modified permit provides a map of the Zone of Mixing (ZOM) and receiving water monitoring station locations.

### 2. Receiving Water Classification

The Mamala Bay, Pacific Ocean, is designated as "Class A Wet Open Coastal Waters" under HAR, Section 11-54-06(b)(2)(B). Protected beneficial uses of

Class A waters include recreation, aesthetic enjoyment, and the protection and propagation of fish, shellfish, and wildlife.

### 3. Ocean Discharge Criteria

The Director has considered the Ocean Discharge Criteria, established pursuant to Section 403(c) of the CWA for the discharge of pollutants into the territorial sea, the waters of the contiguous zone, or the oceans. The United States Environmental Protection Agency (EPA) has promulgated regulations for Ocean Discharge Criteria in 40 Code of Federal Regulations (CFR) Part 125, Subpart M. The Director has determined that the discharge will not cause unreasonable degradation to the marine environment. Based on the current information, the Director proposes to issue the modified permit.

### 4. Impaired Water Bodies on CWA 303(d) List

CWA Section 303(d) requires states to identify specific water bodies where water quality standards are not expected to be met after implementation of technology-based effluent limitations on point sources.

On September 20, 2013, the EPA approved the 2012 State of Hawaii Water Quality Monitoring and Assessment Report, which includes the 2012 303(d) List of Impaired Water Bodies in the State of Hawaii.

The Mamala Bay (off shore) is not listed as an impaired water body for any pollutants in the 2012 303(d) list. Currently, this section of Mamala Bay is reported as a Category 2 waterbody. At present, no TMDLs have been established for this waterbody.

### 5. Summary of Prior Permit Effluent Limitations

#### a. Prior Permit Effluent Limitations and Monitoring Data

Effluent limitations contained in the Prior Permit for discharges from Outfall Serial No. 001 and representative monitoring data from October 2006 through December 2013, are presented in the following tables.

**Table F-2. Historic Effluent Limitations and Monitoring Data – Outfall Serial No. 001**

| Parameter | Units | Effluent Limitation | | | Reported Data[1] | | |
|---|---|---|---|---|---|---|---|
| | | Average Monthly | Average Weekly | Maximum Daily | Average Monthly | Average Weekly | Maximum Daily |
| Flow | MGD | [2] | [2] | [2] | 76 | 98 | 149 |
| Biochemical Oxygen Demand (5-Day) | mg/L | 116[3] | 160[3] | [2] | 128[4] | 134[4] | 180[4] |
| | lbs/day | 79,330[3] | 109,421[3] | [2] | 64,653[4] | 69,327[4] | 107,544[4] |
| | mg/L | 119[5] | 122[5] | [2] | 128[6] | 137[6] | 161[6] |
| | lbs/day | 89,414[5] | 91,594[5] | [2] | 60,361[6] | 66,022[6] | 75,827[6] |
| | % Removal | As a monthly average, not less than 30 percent removal efficiency from influent stream. | | | 28[7] | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Suspended Solids | mg/L | 69[3] | 104[3] | [2] | 48[4] | 59[4] | 90[4] |
| | lbs/day | 47,187[3] | 71,124[3] | [2] | 27,194[4] | 31,519[4] | 71,950[4] |
| | mg/L | 48[5] | 50[5] | [2] | 49[6] | 53[6] | 70[6] |
| | lbs/day | 36,349[5] | 37,403[5] | [2] | 24,434[6] | 31,874[6] | 67,274[6] |
| | % Removal | As a monthly average, not less than 60 percent removal efficiency from influent stream. | | | 71[7] | | |
| Enterococci | CFU/100 ml | -- | -- | 18,000[8] | -- | 16,431[9] | 90,500 |
| Total Residual Chlorine | µg/L | [2] | [2] | 64[8] | [10] | [10] | [10] |

1 Source: Highest reported values from monthly DMRs submitted by the Permittee from December 2006 through June 2011.
2 No effluent limitations for this pollutant in the Prior Permit, only monitoring required.
3 Effluent limitations contained in the Prior Permit.
4 Data reported from October 2006 until November 2010.
5 Interim effluent limitations contained in the 2010 Consent Decree. Interim effluent limitations are applicable until deadlines established in the 2010 Consent Decree.
6 Data reported from December 2010 through December 2013.
7 Data represent minimum percent removal reported.
8 Effluent limitation for enterococci became effective on July 21, 2002.
9 Reported as a geometric mean. Only represents data since the ultraviolet disinfection system became effective in November 2006.
10 The Prior Permit required the Permittee to monitor total residual chlorine upon initiation of chlorination if the Permittee determined that the appropriate disinfection technology to achieve disinfection is chlorination. In November 2006, the Permittee started using UV disinfection; therefore, the Permittee did not submit total residual chlorine data.

**Table F-3. Historic Effluent Limitations and Monitoring Data – Outfall Serial No. 001**

| Parameter | Units | Effluent Limitation | | | Reported Data[1] | | |
|---|---|---|---|---|---|---|---|
| | | Average Annual | Average Monthly | Average Daily | Average Annual | Average Monthly | Average Daily |
| Oil and Grease | mg/L | -- | [2] | [2] | -- | 21.9 | 79.1 |
| | lbs/day | -- | [2] | [2] | -- | 12,154 | 44,355 |
| Total Petroleum Hydrocarbons | mg/L | -- | [2] | [2] | -- | 9.5 | 18.3 |
| | lbs/day | -- | [2] | [2] | -- | 5,192 | 9,881 |
| Fats, Oils, and Greases | mg/L | -- | [2] | [2] | -- | 12.5 | 63.8 |
| | lbs/day | -- | [2] | [2] | -- | 6,962 | 35,777 |
| Temperature | °C | -- | [2] | [2] | -- | 28.2 | 30.4 |
| Total Nitrogen | mg/L | [2] | [2] | NA | 24 | 29.2 | -- |
| | lbs/day | [2] | [2] | NA | 13,351 | 14,339 | -- |
| Total Phosphorus | mg/L | [2] | [2] | NA | 3.15[3] | 3.72[3] | -- |
| | lbs/day | [2] | [2] | NA | 1,724[3] | 1,942[3] | -- |
| pH | s.u. | Not less than 6.0 nor greater than 9.0 | | | 6.45 – 7.49 | | |
| Chronic Toxicity – *Ceriodaphnia Dubia* | TUc | NA | NA | 94 | -- | -- | 46 |
| Chronic Toxicity – *Tripneustes Gratilla* | TUc | NA | NA | [4] | -- | -- | 1428.6 |
| Chlordane | µg/L | 0.0076 | NA | 0.38 | 0.0902 | -- | 0.308 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | lbs/day | 0.0052 | NA | 0.26 | 0.0532 | -- | 0.308 |
| Dieldrin | µg/L | 0.012 | NA | 0.18 | 0.037 | -- | 0.172 |
| | lbs/day | 0.0082 | NA | 0.12 | 0.0242 | -- | 0.172 |

[1] Source: Highest reported values from monthly DMRs submitted by the Permittee from October 2006 through December 2013. Data for Enterococci is limited to data between January 2007 through December 2013 to represent only data since ultraviolet disinfection came online in November 2006.
[2] No effluent limitations for this pollutant in the Prior Permit, only monitoring required.
[3] Reported by the Permittee as total phosphate.
[4] The chronic toxicity discharge limitation of 94 TUc listed in Part A.1 of the Prior Permit does not apply to monitoring results for toxicity tests using *Trypneustes gratilla*.

## 6. Compliance Summary

The following table lists effluent limitation violations as identified in the monthly, quarterly, and annual DMRs submitted by the Permittee from December 2006 to April 2011.

**Table F-4. Summary of Compliance History**

| Monitoring Period | Violation Type | Pollutant | Reported Value | Permit Limitation | Units |
|---|---|---|---|---|---|
| October 2006 – July 2011 | Annual Average | Chlordane | [1] | 0.0076 | µg/L |
| October 2006 – July 2011 | Annual Average | Chlordane | [1] | 0.0052 | lbs/day |
| October 2006 – July 2011 | Annual Average | Dieldrin | [2] | 0.012 | µg/L |
| October 2006 – July 2011 | Annual Average | Dieldrin | [2] | 0.0082 | lbs/day |
| October 2006 – July 2011 | Annual Average | Enterococci | [3] | 18,000 | CFU/100 mL |
| March 2007 | Monthly Average | $BOD_5$ | 117 | 116 | mg/L |
| June 2007 | Monthly Average | $BOD_5$ | 119 | 116 | mg/L |
| October 2007 | Monthly Average | $BOD_5$ | 120 | 116 | mg/L |
| February 2010 | Monthly Average | $BOD_5$ | 118 | 116 | mg/L |
| March 2010 | Monthly Average | $BOD_5$ | 119 | 116 | mg/L |
| March 2011 | Weekly Average | $BOD_5$ | 125 | 122 | mg/L |
| March 2011 | Weekly Average | $BOD_5$ | 124 | 122 | mg/L |
| May 2011 | Weekly Average | $BOD_5$ | 124 | 122 | mg/L |
| May 2011 | Monthly Average | $BOD_5$ | 120 | 119 | mg/L |

[1] Chlordane samples exceeded the concentration and mass-based annual average effluent limitations 52 times from October 2006 through July 2011. Effluent limitations in the Prior Permit for chlordane were based on a human health water quality standard that was printed incorrectly in HAR, Chapter 11-54, and thus effluent limitations were 10 times smaller than necessary to protect the receiving water beneficial uses. The water quality standards have been amended in HAR, Chapter 11-54, and the modified permit will reflect this amendment.
[2] Dieldrin samples exceeded the concentration-based annual average effluent limitations 52 times and mass-based annual average effluent limitations 44 times from October 2006

| Monitoring Period | Violation Type | Pollutant | Reported Value | Permit Limitation | Units |
|---|---|---|---|---|---|

through July 2011.

[3] Enterococci samples exceeded daily maximum effluent limitation 35 times from October 2006 through July 2011.

### 7. Consent Decree and Planned Changes

On December 17, 2010, a Consent Decree (2010 Consent Decree) was entered in *United States of America v. City and County of Honolulu* to resolve litigation between the Permittee, the United States, State of Hawaii, and certain other parties. Under the 2010 Consent Decree, collection system work is to occur through 2020 and the Permittee is required to complete various plant upgrades necessary to comply with secondary treatment standards at two of its wastewater treatment plants, including the SIWWTP. The SIWWTP is to complete construction of the upgrades no later than December 31, 2038. Until the facility achieves compliance with secondary treatment standards, the Permittee is subject to interim effluent limitations for $BOD_5$ and TSS. The deadlines for completing the upgrades are as follows:

**Table F-5. 2010 Consent Decree Deadlines**

| Deadline | Requirement |
|---|---|
| 1/1/2019 | Execute a design contract, and issue a notice to proceed with design. |
| 1/1/2022 | Execute a construction contract, and issue a notice to proceed with construction. |
| 1/1/2024 to 12/31/2025 | If required, submit a proposal and financial analyses to extend deadline to no later than 12/31/2038. |
| 1/1/2030 | If the 2022 notice to proceed does not include all work due to phasing of the project, execute construction contract(s) and issue notice(s) to proceed for remaining work. |
| 12/31/2035 | Complete construction of facilities, unless proposal for deadline extension was approved. |
| Extended deadline no later than 12/31/2038 | If proposal for extended deadline was approved, complete construction of facilities by that deadline. |

## C. Applicable Plans, Policies, and Regulations

### 1. Hawaii Administrative Rules, Chapter 11-54

On November 12, 1982, the HAR, Title 11, Department of Health, Chapter 54 became effective (hereinafter HAR, Chapter 11-54). HAR, Chapter 11-54 was amended and compiled on October 6, 1984; April 14, 1988; January 18, 1990; October 29, 1992; April 17, 2000; October 2, 2004; June 15, 2009; October 21, 2012, and the most recent amendment was on November 15, 2014. HAR, Chapter 11-54 establishes beneficial uses and classifications of state waters, the state antidegradation policy, zones of mixing standards, and water quality criteria that are applicable to Honolulu Harbor.

Requirements of the modified permit implement HAR, Chapter 11-54.

### 2. Hawaii Administrative Rules, Chapter 11-55

On November 27, 1981 HAR, Title 11, Department of Health, Chapter 55 became effective (hereinafter HAR, Chapter 11-55). HAR Chapter 11-55 was amended and compiled on October 29, 1992; September 22, 1997; January 6, 2001; November 7, 2002; August 1, 2005; October 22, 2007; June 15, 2009, October 21, 2012, and the most recent amendment was on November 15, 2014. HAR, Chapter 11-55 establishes standard permit conditions and requirements for NPDES permits issued in Hawaii.

Requirements of the modified permit implement HAR, Chapter 11-55.

### 3. State Toxics Control Program

NPDES Regulations at 40 CFR 122.44(d) require permits to include water quality-based effluent limitations (WQBELs) for pollutants, including toxicity, that are or may be discharged at levels that cause, have reasonable potential to cause, or contribute to an exceedance of a water quality standard. The *State Toxics Control Program: Derivation of Water Quality-Based Discharge Toxicity Limits for Biomonitoring and Specific Pollutants* (hereinafter, STCP) was finalized in April 1989, and provides guidance for the development of water quality-based toxicity control in NPDES permits by developing the procedures for translating water quality standards in HAR, Chapter 11-54, into enforceable NPDES permit limitations. The STCP identifies procedures for calculating permit limitations for specific toxic pollutants for the protection of aquatic life and human health. Guidance contained in the STCP was used to determine effluent limitations in the modified permit.

## D. Rationale for Effluent Limitations and Discharge Specifications

The CWA requires point source Permittees to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. The control of pollutants discharged is established through effluent limitations and other requirements in NPDES permits. NPDES regulations establish two (2) principal bases for effluent limitations. At 40 CFR 122.44(a), permits are required to include applicable technology-based limitations and standards; and at 40 CFR 122.44(d), permits are required to include WQBELs to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water. When numeric water quality objectives have not been established, but a discharge has the reasonable potential to cause or contribute to an excursion above a narrative criterion, WQBELs may be established using one (1) or more of three (3) methods described at 40 CFR 122.44(d) – 1) WQBELs may be established using a calculated water quality criterion derived from a proposed state criterion or an explicit state policy or regulation interpreting its narrative criterion; 2) WQBELs may be established on a case-by-case basis using EPA criteria guidance published under CWA Section 304(a); or 3) WQBELs may be established using an indicator parameter for the pollutant of concern.

## 1. Technology-Based Effluent Limitations

### a. Scope and Authority

Section 301(b) of the CWA and implementing EPA permit regulations at 40 CFR 122.44 require that permits include conditions meeting applicable technology-based requirements at a minimum, and any more stringent effluent limitations necessary to meet applicable water quality standards. The discharge authorized by this modified permit must meet minimum federal technology-based requirements based on Secondary Treatment Standards at 40 CFR 133.

Regulations promulgated in 40 CFR 125.3(a)(1) require technology-based effluent limitations for municipal Permittees to be placed in NPDES permits based on Secondary Treatment Standards or Equivalent to Secondary Treatment Standards.

The Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) established the minimum performance requirements for publicly owned treatment works (POTWs) [defined in section 304(d)(1)]. CWA Section 301(b)(1)(B) requires that such treatment works must, at a minimum, meet effluent limitations based on secondary treatment as defined by the EPA Administrator.

Based on this statutory requirement, EPA developed secondary treatment regulations, which are specified in 40 CFR 133. These technology-based regulations apply to all municipal wastewater treatment plants and identify the minimum level of effluent quality attainable by secondary treatment in terms of 5-day biochemical oxygen demand ($BOD_5$), total suspended solids (TSS), and pH.

### b. Applicable Technology-Based Effluent Limitations

During the drafting of the Prior Permit, the EPA granted a 301(h) variance from secondary treatment requirements for the facility. As a result, $BOD_5$ and TSS effluent limitations contained in the Prior Permit were less stringent than secondary treatment standards and were based on data collected at the facility from January 1993 through December 1997.

On May 5, 2003, the Permittee submitted an application for renewal of its 301(h) variance along with an application for renewing the NPDES permit. On February 9, 2009, the EPA's decision to deny the Permittee's application for a 301(h) variance became effective. The denial was on the ground that the EPA concluded that the applicant's proposed discharge will not comply with the requirements of CWA Section 301(h) and 40 CFR 125, Subpart G, and the water quality standards of HAR, Chapter 11-54. Therefore, technology-based effluent limitations in the modified permit are based on secondary treatment standards contained in 40 CFR 133, as described below.

At 40 CFR 133 in the Secondary Treatment Regulations, EPA has established the minimum required level of effluent quality attainable by secondary treatment shown in Table F-6 below. The standards in Table F-6 are applicable to the facility and therefore established in the modified permit as technology-based effluent limitations.

**Table F-6. Applicable Technology-Based Effluent Limitations**

| **Parameter** | **Units** | **30-Day Average** | **7-Day Average** |
|---|---|---|---|
| $BOD_5$[1] | mg/L | 30 | 45 |
| TSS[1] | mg/L | 30 | 45 |
| pH | standard units | 6.0 – 9.0 | |

[1] The 30-day average percent removal shall not be less than 85 percent.

However, Paragraph 31 of the 2010 Consent Decree establishes interim effluent limitations and monitoring requirements for Sand Island for flow, $BOD_5$ and TSS. Paragraph 32 of the 2010 Consent Decree specifically states, *"From the Effective Date of this Consent Decree until the final compliance milestone set pursuant to Paragraph 31 for the Sand Island WWTP, CCH shall comply with the requirements and interim effluent limits for TSS and $BOD_5$ set forth for the Sand Island WWTP, notwithstanding any final effluent limitations for TSS and BOD5 set forth in CCH's applicable NPDES permit for the Sand Island WWTP; provided, however, that this Consent Decree shall not affect the force or effect of any other effluent limitations, or monitoring and reporting requirements, or any other terms and conditions of its applicable NPDES permit."*

The DOH is recognizing the interim limits for $BOD_5$ and TSS as set forth in the Consent Decree, as those interim limits were performance-based and established to ensure that a minimum level of treatment is maintained until the treatment plant is upgraded to full secondary treatment.

## 2. Water Quality-Based Effluent Limitations (WQBELs)

### a. Scope and Authority

NPDES Regulations at 40 CFR 122.44(d) require permits to include WQBELs for pollutants, including toxicity, that are or may be discharged at levels that cause, have reasonable potential to cause, or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard (reasonable potential). As specified in 40 CFR 122.44(d)(1)(i), permits are required to include WQBELs for all pollutants "which the Director determines are or may be discharged at a level that will cause, have reasonable potential to cause, or contribute to an excursion above any state water quality standard."

The process for determining reasonable potential and calculating WQBELs, when necessary, is intended to protect the receiving waters as specified in HAR, Chapter 11-54. When WQBELs are necessary to protect the receiving waters, the DOH has followed the requirements of HAR, Chapter 11-54, the STCP, and other applicable State and federal guidance policies to determine WQBELs in the modified permit.

Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELS must be established in accordance with the requirements of 40 CFR 122.44(d)(1)(vi), using (1) EPA criteria guidance under CWA Section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information.

**b. Applicable Water Quality Standards**

The beneficial uses and water quality standards that apply to the receiving waters for this discharge are from HAR, Chapter 11-54.

**(1) HAR, Chapter 11-54.** HAR, Chapter 11-54 specifies numeric aquatic life standards for 72 toxic pollutants and human health standards for 60 toxic pollutants, as well as narrative standards for toxicity. Effluent limitations and provisions in the modified permit are based on available information to implement these standards.

**(2) Water Quality Standards.** The facility discharges to the Mamala Bay, Pacific Ocean, which is classified as a Marine Class A Wet Open Coastal Waters in HAR, Chapter 11-54. As specified in HAR, Chapter 11-54, saltwater standards apply when the dissolved inorganic ion concentration is above 0.5 parts per thousand. As such, a reasonable potential analysis (RPA) was conducted using saltwater standards. Additionally, human health water quality standards were also used in the RPA to protect human health. Where both saltwater standards and human health standards are available for a particular pollutant, the more stringent of the two (2) was used in the RPA.

40 CFR 122.45(c) requires effluent limitations for metals to be expressed as total recoverable metal. Since water quality standards for metals are expressed in the dissolved form in HAR, Chapter 11-54, factors or translators must be used to convert metal concentrations from dissolved to total recoverable. Default EPA conversion factors were used to convert the applicable dissolved criteria to total recoverable.

**(3) Receiving Water Hardness.** HAR, Chapter 11-54 contains water quality criteria for six (6) metals that vary as a function of hardness in freshwater. A lower hardness results in a lower freshwater water quality standard. The metals with hardness dependent standards include cadmium, copper, lead, nickel, silver, and zinc. Ambient hardness values are used to calculate freshwater water quality standards that are hardness dependent. Since saltwater standards are used for the RPA, the receiving water hardness was not taken into consideration when determining reasonable potential.

**c. Determining the Need for WQBELs**

NPDES regulations at 40 CFR 122.44(d) require effluent limitations to control all pollutants which are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard. Assessing whether a pollutant has reasonable potential is the fundamental step in determining whether or not a WQBEL is required.

**(1) Reasonable Potential Analysis (RPA).**

**Toxic Pollutants** Using the methods prescribed in EPA's *Technical Support Document for Water Quality-Based Toxics Control* (the TSD, EPA/505/2-90-001, 1991), the effluent data for toxic pollutants discharged at Outfall Serial No. 001 was analyzed to determine if the discharge demonstrates reasonable potential. The RPA for pollutants with WQS specified in HAR, Chapter 11-54-4, based on the TSD, combines knowledge of effluent variability as estimated by a coefficient of variation with the uncertainty due to a limited number of data to project an estimated maximum receiving water concentration as a result of the effluent. The estimated receiving water concentration is calculated as the upper bound of the expected lognormal distribution of effluent concentrations at a high confidence level. The projected maximum receiving water concentration, after consideration of dilution, is then compared to the WQS in HAR, Chapter 11-54, to determine if the pollutant has reasonable potential. The projected maximum receiving water concentration has reasonable potential if it cannot be demonstrated with a high confidence level that the upper bound of the lognormal distribution of effluent concentrations is below the receiving water standards. Step one of the RPA process compared the effluent data with numeric and narrative water quality standards in HAR, Chapter 11-54-4.

Projected Maximum RWC = MEC x $99\%_{ratio}$ x Dm

Where:

RWC = Receiving water concentration
MEC = Maximum effluent concentration reported
$99\%_{ratio}$ = The 99% ratio from Table 3-1 in the TSD or calculated using methods in Section 3.3.2 of the TSD

Dm = Percent Dilution (i.e., 221:1, or 0.45%, for chronic toxicity standards and human health standards for non-carcinogens, and 550:1, or 0.18% for human health standards for carcinogens)

Due to the long exposure time associated with human health criteria for carcinogens (e.g. 70 years), and because the human health criteria for carcinogens is expressed as an annual average, where carcinogens were flagged for reasonable potential using the TSD method, a second step in the RPA was performed to account for the longer exposure period. If a carcinogen was flagged using the TSD method, annual averages over calendar years were compared directly to the water quality criteria, after mixing, to evaluate reasonable potential. The carcinogens triggered for further evaluation by the TSD RPA procedures were dieldrin and chlordane.

The reasonable potential analysis followed the guidance set forth by the EPA through its Region 10 in *EPA Region 10 Guidance for WQBELs Below Analytical Detection/Quantitation Level*, EPA, 1996 in its treatment of data that is detected at limits below the Minimum Level (i.e., the level at which the parameter may be accurately quantified) or the Detection Limit. Where the maximum annual average concentration is greater than the applicable water quality standard from HAR, Chapter 11-54, then reasonable potential exists for the pollutant, and effluent limitations are established.

**Nutrients** For nutrients, the most stringent WQS specified in HAR, Chapter 11-54-6, are provided as geometric means and exceedances of these WQS are less sensitive to effluent variability. The RPA was conducted by doing a direct comparison of the maximum annual geometric mean of data analyzed for each ZOM station to the applicable geometric mean listed in HAR, 11-54-6. Dilution is not taken into account because the data from samples collected in the receiving water ZOM stations were used.

**(2) Effluent Data.** The RPA for the 2014 Permit was based on the effluent monitoring data submitted to the DOH in DMRs from October 2006 through December 2013. The additional reasonable potential evaluation for dieldrin and chlordane was performed using effluent data from January 2013 through March 2017. The data period for chlordane and dieldrin is sufficient to accurately characterize the anticipated effluent quality and account for variability within the effluent.

**(3) Dilution.** The 2014 Permit included a minimum initial dilution of 103:1 and an average initial dilution of 294:1 based on EPA conducted dilution modeling using Visual PLUMES Three-Dimensional Updated Merge model (“Visual PLUMES”), which evaluated 33 receiving water temperature and salinity depth profiles from February 1999 through April 2007. The above dilution values were based solely on the temperature and salinity profiles from July 2, 2002 because EPA determined that it represented a conservative estimate of ambient conditions into which the Permittee discharges, and thus would be protective of water quality.

On June 29, 2017, the Permittee submitted a dilution study for the facility using NRFIELD, the latest version of the Visual PLUMES model for dilution calculations ("2017 Sand Island Dilution Study," Appendix 1). The model evaluated the minimum dilution and average dilution in the initial mixing zone where jet and buoyant near field processes occur, as well as the far field dilution (with and without the bacterial decay process) using the most appropriate available data.

For initial mixing, the model considered more recent ambient and effluent data and model input values that accurately reflect current operating and environmental conditions, including:

- ocean current measurements recorded at 20-minute intervals taken over a 27 month period from January 22, 2007 through April 19, 2009;
- quarterly ambient CTD data from 2012 through 2016;
- effluent temperature and salinity data; and
- peak 3-hour flow rate data from 2012-2016 as well as the average growth rate for each year to establish the projected 3 hour peak flow of 97.2 mgd for 2021.

The Permittee's 2017 Sand Island Dilution Study appears to represent ambient conditions accurately. For the development of this permit modification, DOH is using the critical short term initial dilution of 221:1 for chronic aquatic toxicity and fish consumption criteria for non-carcinogens, and 550:1 for fish consumption criteria for carcinogens.

HAR, Chapter 11-54-9, allows the use of a ZOM to demonstrate compliance with WQS. ZOMs consider initial dilution, dispersion, and reactions from substances which may be considered to be pollutants. For Section 11-54-6 parameters, reasonable potential to contribute to an exceedance of WQS is most reasonably assessed by comparing monitoring data at the edge of the ZOM to the applicable WQS. If an annual geometric mean at the edge of a ZOM exceeds the applicable WQS, the Permittee is determined to have reasonable potential for the pollutant. If an exceedance of WQS is not observed at the edge of the ZOM, it is assumed that sufficient dilution and assimilative capacity exists to meet WQS at the edge of the ZOM.

The modified permit requires the Permittee to conduct a dilution analysis and assimilative capacity study at the edge of the ZOM so that end-of-pipe effluent limitations may be established, if needed, during future permitting efforts. Where assimilative capacity does not exist, it is not appropriate to grant a ZOM and/or dilution, and an end-of-pipe criteria-based effluent limitation must be established that is protective of WQS.

Assimilative capacity for pollutants with reasonable potential is evaluated for Section 11-54-6 pollutants by aggregating all ZOM control station data annually and comparing the annual geometric means to the applicable WQS. If an annual geometric mean exceeds 90 percent of the WQS, assimilative capacity is determined to be insufficient and dilution may not be granted.

**(4) Summary of RPA Results.** The maximum effluent concentrations from the DMRs over the current permit term and the NPDES Application Form 2C, maximum projected receiving water concentration after dilution calculated using methods from the TSD, the applicable HAR, Section 11-54-4(b)(3) and 11-54-6(b)(3) water quality standard, and result of the RPA for pollutants discharged from Outfall Serial No. 001 is presented in Table F-8, below. The maximum projected concentrations for toxics specified in HAR, Section 11-54-4 have been revised to reflect available dilution. For nutrients and water quality standards specified in HAR, Section 11-54-6(b)(3), dilution, where available, has been accounted for within the summarized applicable water quality standard. Only pollutants detected in the discharge are presented in Table F-8. All other pollutants were not detected and therefore, no reasonable potential exists.

Data for toxic pollutants is based on semi-annual reports from 2007 through 2011 and is consistent with the data used in the 2014 Permit, prior to the Stipulated Order. However, the effluent concentration values provided for dieldrin and chlordane represent annual averages from January 2012 through March 2017, as previously described. When effluent results were reported below the method detection limit for the analytical method, zero was used for those data points when determining an annual average. The use of zero for results below the method detection limit for the purposes of an RPA is consistent with EPA Region 10's *Guidance for WQBELs Below Analytical Detection/Quantification Level*, EPA, 1996.

Reasonable potential for ammonia nitrogen was evaluated using recent data from January 2014 through December 2016. Because the criteria for ammonia nitrogen is calculated using a geometric mean, the use of zero for non-detect results, consistent with EPA Region 10 guidance, is not possible. The substitution method was utilized to account for non-detects when calculating a geometric mean. During the development of the 2014 Permit, a substitution method of one-half the method detection limit was used. When re-evaluating reasonable potential for ammonia nitrogen, a substitution value of one-quarter of the method detection limit was used, which is closer to zero than previously used and consistent with the intent of the EPA guidance, but still allows for the calculation of a geometric mean. Using this revised RPA method for ammonia nitrogen with recent data from 2014, 2015, and 2016, reasonable potential does not exist for ammonia nitrogen.

**Table F-8. Summary of RPA Results**

| Parameter | Units | Number of Samples | Dilution | Maximum Effluent Concentration | Maximum Projected Concentration | Applicable Water Quality Standard | RPA Results |
|---|---|---|---|---|---|---|---|
| Antimony, Total Recoverable | µg/L | 14 | 221 | 1.6 | 0.023 | 15,000 | No |
| Arsenic, Total Recoverable | µg/L | 14 | 221 | 1.5 | 0.022 | 36 | No |
| Beryllium, Total Recoverable | µg/L | 14 | 550 | 0.44 | 0.0026 | 0.038 | No |
| Cadmium, Total Recoverable | µg/L | 14 | 221 | 0.13 | 0.0019 | 9.4 | No |
| Chromium, Total Recoverable | µg/L | 14 | 221 | 4.8 | 0.070 | 50 | No |
| Copper, Total Recoverable | µg/L | 14 | 221 | 40 | 0.58 | 3.5 | No |
| Cyanide, Total Recoverable | µg/L | 14 | 221 | 10 | 0.14 | 1.0 | No |
| Lead, Total Recoverable | µg/L | 14 | 221 | 19 | 0.28 | 5.9 | No |
| Mercury, Total Recoverable | µg/L | 14 | 221 | 0.06 | 0.00087 | 0.025 | No |
| Nickel, Total Recoverable | µg/L | 14 | 221 | 5.9 | 0.085 | 8.4 | No |
| Selenium, Total Recoverable | µg/L | 14 | 221 | 1.2 | 0.017 | 71 | No |
| Silver, Total Recoverable | µg/L | 14 | 221 | 0.80 | 0.0116 | 2.7 | No |
| Thallium, Total Recoverable | µg/L | 14 | 221 | 2.2 | 0.0.032 | 16 | No |
| Zinc, Total Recoverable | µg/L | 14 | 221 | 85 | 1.23 | 91 | No |
| Acrolein | µg/L | 14 | 221 | 1.4 | 0.020 | 18 | No |
| Benzene | µg/L | 14 | 294 | 4.8 | 0.028 | 13 | No |
| Bis(2-Ethylhexyl) Phthalate | µg/L | 14 | 221 | 1.3 | 0.019 | 16,000 | No |
| Chlordane | µg/L | 4 | 550 | 0.00011 | 0.00011 | 0.00016 | No[1] |
| Chloroform | µg/L | 14 | 550 | 1.0 | 0.0058 | 5.1 | No |
| Dieldrin | µg/L | 4 | 550 | 0.00006 | 0.00006 | 0.000025 | Yes[1] |
| Diethyl Phthalate | µg/L | 14 | 221 | 3.1 | 0.045 | 590,000 | No |
| Endosulfan Sulfate | µg/L | 14 | 221 | 0.0090 | 0.00013 | 0.0087 | No |
| Ethylbenzene | µg/L | 14 | 221 | 0.8 | 0.012 | 140 | No |
| Malathion | µg/L | 14 | 221 | 0.22 | 0.0032 | 0.10 | No |
| Phenol | µg/L | 14 | 221 | 5.1 | 0.0704 | 170 | No |
| Toluene | µg/L | 14 | 221 | 21 | 0.30 | 2,100 | No |
| Trichloroethylene | µg/L | 14 | 550 | 0.20 | 0.0012 | 26 | No |

| Parameter | Units | Number of Samples | Dilution | Maximum Effluent Concentration | Maximum Projected Concentration | Applicable Water Quality Standard | RPA Results |
|---|---|---|---|---|---|---|---|
| 1,4-Dichlorobenzene | µg/L | 14 | 221 | 1.4 | 0.020 | 660 | No |
| Total Nitrogen | µg/L | 20 | NA | 120[2] | NA | 150.00 | No |
| Ammonia Nitrogen | µg/L | 20 | NA | 3.4[2] | NA | 3.5 | No |
| Nitrate + Nitrite Nitrogen | µg/L | 20 | NA | 1.85[2] | NA | 5.0 | No |
| Total Phosphorus | µg/L | 20 | NA | 8.82[2] | NA | 20.00 | No |

[1] Chlordane and dieldrin triggered reasonable potential based on the projected receiving water concentration using daily data. However, as previously explained in this fact sheet and in accordance with the Stipulated Order, chlordane and dieldrin were further evaluated based on annual averages from 2013 through 2016 (and January, February, and March of 2017), without the application of multipliers. Because the annual average analysis is the determining factor in evaluating reasonable potential, the annual data is summarized in this table for these two parameters.

[2] Receiving water concentrations.

**(5) Reasonable Potential Determination.**

**(a) Constituents with limited data.** In some cases, reasonable potential cannot be determined because effluent data are limited. The modified permit requires the Permittee to continue to monitor for these constituents in the effluent using analytical methods that provide the lowest available detection limitations. When additional data become available, further RPAs will be conducted to determine whether to add numeric effluent limitations to this modified permit or to continue monitoring.

Data for the following parameters was not available:

- Dichlorobromomethane
- Carbon Tetrachloride
- 1,2-Dichloroethane
- Bromoform
- Chlorodibromomethane
- delta-BHC
- Acenaphthylene
- Acrylonitrile
- Anthracene
- Benzo(b)Fluoranthene
- Benzo(k)Fluoranthene
- Benzo(a)Pyrene
- Bis(2-Chloroethyl)Ether
- Bis(2-Chloroethoxy)Methane
- Bis(2-Chloroisopropyl)Ether

- Butylbenzyl Phthalate
- Chlorobenzene
- Chrysene
- Dimethyl Phthalate
- 1,2-Diphenylhydrazine
- beta-Endosulfan
- alpha-Endosulfan
- Fluoranthene
- Fluorene
- Hexachlorocyclopentadiene
- Hexachloroethane
- Indeno(1,2,3-cd) Pyrene
- Isophorone
- Methyl Bromide
- Methyl Chloride
- N-Nitrosodimethylamine
- N-Nitrosodi-n-Propylamine
- N-Nitrosodiphenylamine
- Nitrobenzene
- Para Chlorometa Cresol
- Phenanthrene
- Pyrene
- Tetrachloroethylene
- 1,1-Dichloroethane
- 1,1-Dichloroethylene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- 1,1,2,2-Tetrachloroethane
- Benzo(ghi)Perylene
- Benzo(a)Anthracene
- 1,2-Dichlorobenzene
- 1,2-Dichloropropane
- 1,2-Trans-Dichloroethylene
- 1,2,4-Trichlorobenzene
- Dibenzo(a,h)Anthracene
- 1,3-Dichlorobenzene
- 2-Chloroethylvinyl Ether
- 2-Chloronaphthalene
- 2-Chlorophenol
- 2-Nitrophenol
- Di-n-Octyl Phthalate
- 2,4-Dichlorophenol
- 2,4-Dimethylphenol
- 2,4-Dinitrotoluene
- 2,4-Dinitrophenol

- 2,4,6-Trichlorophenol
- 2,6-Dinitrotoluene
- 3,3 Dichlorobenzidine
- 4-Bromophenyl Phenyl Ether
- 4-Chlorophenyl Phenyl Ether
- 4-Nitrophenol
- 2-Methyl- 4,6-Dinitrophenol
- PCB-1016
- 2,3,7,8 TCDD
- Naphthalene
- Pentachlorophenol
- Di-n-Butyl Phthalate
- Benzidine
- Vinyl Chloride
- 4,4'-DDE
- Aldrin
- alpha-BHC
- beta-BHC
- gamma-BHC
- Endrin
- Toxaphene
- Heptachlor
- Heptachlor Epoxide
- Methoxychlor
- PCBs
- Parathion
- Demeton
- Guthion
- Hexachlorobenzene
- Hexachlorobutadiene
- Mirex
- 1,3-Dichloropropylene
- Chloroethane
- Chlorophyll a
- Turbidity

**(b) Pollutants with No Reasonable Potential.** WQBELs are not included in this modified permit for constituents listed in HAR, Chapter 11-54-4(c)(3) and 11-54-6(b)(3) that do not demonstrate reasonable potential; however, monitoring for such pollutants is still required in order to collect data for future RPAs. Pollutants with no reasonable potential consist of those identified in Table F-8 or any pollutant identified in this section Part D.2.c.(5).(b) or not discussed in Parts D.2.c.(5).(a) or D.2.c.(5).(c) of this Fact Sheet.

In August 6, 2007 the Permittee reported a detected concentration of DDT at 0.011 ug/L. During the 2014 public comment period for the permit renewal, the Permittee submitted additional laboratory data indicating that the reported value was only one of two results from a split sample. Typical results for split samples are averaged prior to reporting, and the use of a single value may not be appropriate. The second result from the split sample was non-detect, using a method detection limit of 0.003 ug/L. Given the vast difference between the two results, the laboratory has submitted a statement that the reported result may have occurred due to sample contamination. Based on this information, and the fact that the remaining data was non-detect, the DDT result from August 6, 2007 was not used in evaluating reasonable potential for DDT, and reasonable potential was not determined for DDT.

The additional reasonable potential evaluation for chlordane as described in Part D.2.c above resulted in no reasonable potential for chlordane to cause or contribute to an excursion above state water quality standards.

**(c) Pollutants with Reasonable Potential.** The RPA indicated that dieldrin has reasonable potential to cause, or contribute to an excursion above state water quality standards. Thus, WQBELs have been established in this modified permit at Outfall Serial No. 001 for dieldrin.

The WQBELs were calculated based on water quality standards contained in HAR, Chapter 11-54 and procedures contained in both STCP and HAR, Chapter 11-54, as discussed in Part D.2.d, below.

**d. WQBEL Calculations**

Specific pollutant limits may be calculated for both the protection of aquatic life and human health.

**(1) WQBELs based on Aquatic Life Standards.** The STCP categorizes a discharge from a facility into one of four categories: (1) marine discharges through submerged outfalls; (2) discharges without submerged outfalls; (3) discharges to streams; or (4) high-rate discharges. Once a discharge has been categorized, effluent limitations for pollutants with reasonable potential can be calculated, as described below.

**(a)** For marine discharges through submerged outfalls, the daily maximum effluent limitation shall be the product of the chronic water quality standard and the minimum dilution factor;

**(b)** For discharges without submerged outfalls, the daily maximum effluent limitation shall be the acute toxicity standard. More stringent limits based on the chronic standards may be developed using Best Professional Judgment (BPJ);

**(c)** For discharges to streams, the effluent limitation shall be the most stringent of the acute standard and the product of the chronic standard and dilution; and

**(d)** For high rate outfalls, the maximum limit for a particular pollutant is equal to the product of the acute standard and the acute dilution factor determined according to Section II.B.4 of the STCP. More stringent limits based on chronic standards may be developed using BPJ.

**(2) WQBELs based on Human Health Standards.** The STCP specifies that the fish consumption standards are based upon the bioaccumulation of toxics in aquatic organisms followed by consumption by humans. Limits based on the fish consumption standards should be applied as 30-day averages for non-carcinogens and annual averages for carcinogens.

The discharge from this facility is considered a marine discharge through a submerged outfall. Therefore, for pollutants with reasonable potential, the modified permit establishes, on a pollutant by pollutant basis, daily maximum effluent limitations based on saltwater chronic aquatic life standard after considering dilution and average monthly effluent limitations for non-carcinogens or annual average effluent limitations for carcinogens based on the human health standard after considering dilution. WQBELs established in the modified permit are discussed in detail below.

**(3) Calculation of Pollutant-Specific WQBELs**

As discussed in Part D.2.c.(3) of this Fact Sheet, a minimum initial dilution of 221:1 and an average initial dilution of 550:1 have been established.

As discussed above as a second step screening for reasonable potential for carcinogens, the following equation was used:

Projected Maximum AARWC = MAAEC x Dm

Where:

| | | |
|---|---|---|
| AARWC= | | Annual average receiving water concentration |
| MAAEC = | | Maximum annual average effluent concentration reported |
| Dm | = | Percent Dilution (i.e., 550:1, or 0.18% for human health standards for carcinogens) |

If the projected maximum annual average receiving water concentration is greater than the applicable water quality standard from HAR, Chapter 11-54, then reasonable potential exists for the pollutant and effluent limitations are established. Pollutants with reasonable potential are discussed below in detail.

**(a) Dieldrin**

i. **Dieldrin Water Quality Standards.** The most stringent applicable water quality standard for dieldrin is the human health standard of 0.000025 µg/L, as specified in HAR, Chapter 11-54.

ii. **RPA Results.** The last five (5) years of data were evaluated. The highest annual average for dieldrin between January 2012 and December 2016 was 0.03308 µg/L. As discussed in Part D.2.c.(3), the facility is granted a dilution of 550:1 for human health carcinogens. Therefore, Dm = 0.18%.

The maximum annual average effluent concentration for dieldrin was 0.03308 µg/L.

| | | |
|---|---|---|
| Projected Maximum AARWC | = | MAAEC x Dm |
| | = | 0.03308 µg/L x 0.0018 |
| | = | 0.00006 µg/L |
| HAR, Section 11-54 Water Quality Standard | = | 0.000025 µg/L |

The projected maximum annual average receiving water concentration (0.00006 µg/L) exceeds the most stringent applicable water quality standard for this pollutant (0.000025 µg/L), demonstrating reasonable potential. Therefore, the modified permit establishes effluent limitations for dieldrin.

iii. **Dieldrin WQBELs.** WQBELs for dieldrin were calculated using STCP procedures and are based on the chronic aquatic life water quality standard and the human health standard. Based on the chronic aquatic life water quality standard and a dilution of 221:1, the modified permit establishes a daily maximum effluent limitation for dieldrin of 0.42 µg/L. The annual average effluent limitation of 0.0138 µg/L is based on the human health standard for carcinogens and a dilution of 550:1. However, in accordance with the Region 10, when the Minimum Level (ML) of the analysis is greater than the limitation of 0.0138 µg/L, the compliance level shall be the value of the ML for the specific laboratory analysis result.

**iv. Feasibility.** The highest daily maximum effluent concentration reported for dieldrin between January 2014 and March 2017 was 0.0587 µg/L. Since the maximum effluent concentration is less than the maximum daily effluent limitation of 0.42 µg/L, the DOH has determined that the facility will be able to comply with proposed maximum daily dieldrin effluent limitations.

Although the annual average effluent concentrations prior to 2015 are greater than the proposed annual average effluent limitation of 0.0138 µg/L and the MLs for dieldrin analysis (0.0187 µg/L and 0.0201 µg/L), the annual averages calculated since 2015 have been below these numbers and thus the DOH has determined that the facility should be able to comply with proposed annual average effluent limitation.

**e. pH**

The Permittee was previously granted a ZOM for pH to comply with water quality standards for open coastal waters in HAR, Section 11-54-6(b)(3). Receiving water data from March 2006 through April 2013 indicate compliance with the water quality objectives for pH at the edge of the ZOM. The technology-based effluent limitations of between 6.0 to 9.0 at all times appear to be protective of water quality outside the ZOM and have been carried over.

**f. Enterococcus**

The 2014 Permit contained a maximum daily discharge limitation of 18,000 CFU/100mL and an average monthly discharge limitation of 3,605 CFU/100mL. The maximum daily discharge limitation was carried over from the Prior Permit due to antibacksliding and antidegradation regulations. The average monthly discharge limitation was based on 40 CFR Section 131.41(a)(5) and the water quality objectives in HAR, Section 11-54-8(b) for marine recreational waters within 300 meters (1,000 feet) of shore in effect at the time of issuance (35 CFR/100mL) and the minimum initial dilution 103:1.

On November 15, 2014, the State amended HAR, Section 11-54-8(b) to adopt new recreational water quality standards. The amended standards were approved by EPA on May 20, 2015. As amended, HAR, Section 11-54-8(b) establishes recreational criteria for all State waters designed to protect the public from exposure to harmful levels of pathogens while participating in water-contact activities. The specified recreational criteria for all State waters are: a geometric mean of 35 CFU/100 mL over any thirty-day interval and a Statistical Threshold Value (STV) of 130 CFU/100 mL, which may not be exceeded in more than ten percent of samples taken within the same thirty-day interval in which the geometric mean is calculated.

The modified permit establishes a monthly average effluent limitation of 19,250 CFU/100 mL based on the enterococcus geometric mean of 35 CFU/100 mL and the average initial dilution of 550:1. It also establishes a daily maximum effluent limitation, which may not be exceeded in more than ten percent of samples taken within the same thirty-day interval in which the geometric mean was calculated, of 28,730 CFU/100 mL based on the STV of 130 mL and a minimum initial dilution of 221:1.

With the exception of the period from December 21, 2016 to December 27, 2016 where daily maximum enterococcus levels were high due to a temporary process upset, the highest daily maximum enterococcus effluent limit reported during the 2014 Permit term was 24,915 CFU/100 mL (2016). In addition, during the 2014 Permit term, and with the exception of December 2016, the facility has never exceeded the monthly geometric mean effluent limitation of 19,250 CFU/100 mL. Moreover, lower enterococcus concentrations are expected to be achieved following the upgrades to the treatment plant required by the 2010 Consent Decree. Therefore, DOH has determined that the facility should be able to meet the proposed daily maximum and monthly average enterococcus effluent limitations immediately and has removed the compliance schedule.

Geosyntec Consultants evaluated the potential impact of raising the daily maximum effluent limitation and determined available assimilative capacity would be reduced by 1.3% at offshore stations and 1.1% at nearshore stations (Appendix 1).

**g. Whole Effluent Toxicity (WET)**

WET limitations protect receiving water quality from the aggregated toxic effect of a mixture of pollutants in an effluent. WET tests measure the degree of response of exposed aquatic test organisms to an effluent or receiving water. The WET approach allows for protection of the narrative criterion specified in HAR, Chapter 11-54-4(b)(2) while implementing Hawaii’s numeric WQS for toxicity. There are two types of WET tests – acute and chronic. An acute toxicity test is conducted over a short period of time and measures mortality. A chronic toxicity test is generally conducted over a longer period of time and may measure mortality, reproduction, or growth.

The Prior Permit established a chronic WET effluent limitation at Outfall Serial No. 001 for *Ceriodaphnia dubia* ("*C. dubia*") and additional monitoring for *Tripneustes gratilla* ("*T. gratilla*").

Whole effluent toxicity data for the time period between October 2006 and December 2013 using the test species *C. dubia* did not result in an exceedance of the chronic toxicity effluent limitation, however monitoring results for *T. gratilla* indicate that the Permittee has reasonable potential to exceed the effluent limitation for chronic toxicity of 94 $TU_c$ established in the Prior Permit for Outfall Serial No. 001, with effluent results as high as >1428.6 TUc, during 79 of the 82 months during the time period between October 2006 and December 2013 (results were not submitted for some months).

With the 2014 Permit, for improved WET analysis, DOH has begun implementing EPA's Test of Significant Toxicity Method (TST) for WET effluent limitations within the State. As such, the chronic WET effluent limitation at Outfall Serial No. 001 has been revised to be consistent with the TST method using *T. gratilla*, a native species to Hawaii.

Test procedures for measuring toxicity to marine organisms of the Pacific Ocean, including *T. gratilla*, are not provided at 40 CFR 136. Consistent with the Preamble to EPA's 2002 Final WET Rule, permit writers may include (under 40 CFR 122.41(j)(4) and 122.44(i)(iv)) requirements for the use of test procedures that are not approved at 40 CFR Part 136 on a permit-by-permit basis. The use of alternative methods for west coast facilities in Hawaii is further supported under 40 CFR 122.21(j)(5)(viii), which states, "West coast facilities in…, Hawaii,… are exempted from 40 CFR [P]art 136 chronic methods and must use alternative guidance as directed by the permitting authority."

EPA has issued applicable guidance for conducting chronic toxicity tests using *T. gratilla* in Hawaiian Collector Urchin, *Tripneustes gratilla* (Hawa'e) Fertilization Test Method (Adapted by Amy Wagner, EPA Region 9 Laboratory, Richmond, CA from a method developed by George Morrison, EPA, ORD Narragansett, RI and Diane Nacci, Science Applications International Corporation, ORD Narragansett, RI) (EPA/600/R-12/022).

As previously discussed, reasonable potential for WET has been determined for Outfall Serial No. 001 and an effluent limitation must be established in accordance with 40 CFR 122.44(d)(1). Further, a WET effluent limitation and monitoring are necessary to ensure compliance with applicable WQS in HAR, Chapter 11-54-4(b)(2).

The proposed WET limitation and monitoring requirements were incorporated into the modified permit in accordance with the EPA national policy on water quality-based permit limitations for toxic pollutants issued on March 9, 1984 (49 FR 9016), HAR, Section 11-54-4(b)(2)(B), and EPA's National Pollutant

Discharge Elimination System Test of Significant Toxicity Implementation Document (EPA 833-R-10-003, 2010).

Consistent with HAR, Chapter 11-54-4(b)(2)(B), the 2014 Permit established a chronic toxicity effluent limitation based on the TST hypothesis testing approach. The TST approach was designed to statistically compare a test species response to the in-stream waste concentration (IWC) and a control.

For continuous discharges through submerged outfalls, HAR, Section 11-54-4(b)(4)(A) requires the no observed effect concentration (NOEC), expressed as a percent of effluent concentration, to not be less than 100 divided by the minimum dilution.

The 2017 Sand Island Dilution Study minimum dilution of 221:1 used to determine an applicable IWC is greater than the previous initial minimum dilutions used to calculate the IWC which were 94:1 (in 1998) and 103:1 (in 2014). The use of 221:1 dilution is based on the availability of new information contained within the Permittee's 2017 Sand Island Dilution Study, and is consistent with Section 402(o)(2) of the CWA's backsliding requirements. Further, the Permittee's historic effluent data indicates frequent occurrences of elevated levels of toxicity (routinely exceeding 357 $TU_c$) with *T. gratilla*, justifying the need for greater dilution. Because the Permittee has historically exceeded 357 $TU_c$ using *T. gratilla*, an effluent limitation based on an IWC of 221:1 would not result in any additional pollutant loading of toxic substances greater than is currently being discharged.

CWA Section 402(o)(1) prohibits the relaxation of effluent limitations based on state water quality standards unless the change is consistent with CWA Section 303(d)(4). CWA Section 303(d)(4) allows for discharges to waters attaining standards to have relaxed effluent limitations if the less stringent limitations are subject to, and consistent with, the state antidegradation policy. As discussed further in Part D.2.j, DOH finds that the modification is consistent with HAR Chapter 11-54-1.1, and that backsliding of the WET limitation is allowable.

The following equation is used to calculate the IWC where dilution is granted (Outfall Serial No. 001):

IWC = 100/critical dilution factor

= 100/221

= 0.45%

For any one chronic toxicity test, the chronic WET permit limit that must be met is rejection of the null hypothesis (Ho):

IWC (percent effluent) mean response ≤ 0.75 × Control mean response.

A test result that rejects this null hypothesis is reported as "Pass". A test result that does not reject this null hypothesis is reported as "Fail"

The acute and chronic biological effect levels (effect levels of 20% and 25%, respectively, or b values of 0.80 and 0.75, respectively) incorporated into the TST define EPA's unacceptable risks to aquatic organisms and substantially decrease the uncertainties associated with the results obtained from EPA's traditionally used statistical endpoints for WET. Furthermore, the TST reduces the need for multiple test concentrations which, in turn, reduces laboratory costs for Permittees while improving data interpretation. A significant improvement offered by the TST approach over traditional hypothesis testing is the inclusion of an acceptable false negative rate. While calculating a range of percent minimum significant differences (PMSDs) provides an indirect measure of power for the traditional hypothesis testing approach, setting appropriate levels for β and α using the TST approach establishes explicit test power and provides motivation to decrease within test variability which significantly reduces the risk of under reporting toxic events (USEPA 20101).

Taken together, these refinements simplify toxicity analyses, provide Permittees with the positive incentive to generate high quality data, and afford effective protection to aquatic life.

A WET effluent limitation based on the TST hypothesis testing approach is protective of the WQS for toxicity contained in HAR, Section 11-54-4(b)(4)(B) and is not considered to be less stringent. Use of the TST approach is consistent with the requirements of State and federal anti-backsliding regulations.

Under the modified permit, the Permittee will be required to add two (2) additional test animals for WET testing (specifically, *C. dubia* and *Atherinops affinis*) to the current test species, *T. gratilla*. Accordingly, the Permittee shall conduct chronic toxicity testing on three species in accordance with

1 U.S. Environmental Protection Agency. 2002a. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (5th Edition). EPA 821-R-02-012. Washington, DC: Office of Water.

appropriate test methods, rotating the test species month by month such that each test species is tested once every quarter.

### h. Summary of Final Effluent Limitations

In addition to the effluent limitations specified above, HAR, Section 11-55-20 requires that daily quantitative limitations by weight be established where possible. Thus, in addition to concentration based-effluent limitations, mass-based effluent limitations (in pounds per day) have been established where applicable based on the following formula:

lbs/day = 8.34 * concentration (mg/L) * flow (MGD)

40 CFR 122.45(b)(1) requires that mass-based effluent limitations for POTWs be based on design flow. The Prior Permit established mass based effluent limitations on the facility design flow of 82 MGD at the time the Prior Permit was adopted. However, Part A.2.f of the Prior Permit required the Permittee to construct additional primary treatment facilities, including pretreatment facilities, to expand the treatment plant capacity from 82 MGD to 90 MGD. Because the increase in flow was authorized by the Prior Permit, it was not subject to additional anti-degradation analysis during the 2014 Permit renewal or 2017 permit modification.

The following table lists final effluent limitations contained in the modified permit and compares them to effluent limitations contained in the 1998 and 2014 Permits.

**Table F-9. Summary of Final Effluent Limitations – BOD and TSS**

| Parameter | Units | Effluent Limitations Contained in the Prior Permit | | | Effluent Limitations[2] | | |
|---|---|---|---|---|---|---|---|
| | | Average Monthly | Average Weekly | Maximum Daily | Average Monthly | Average Weekly | Maximum Daily |
| Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) | mg/L | 116[1] | 160[1] | -- | 30 | 45 | -- |
| | lbs/day | 79,330[3] | 109,421[3] | -- | 22,518[4] | 33,777[4] | -- |
| | % Removal | As a monthly average, not less than 30 percent removal efficiency from the influent stream. | | | The average monthly percent removal shall not be less than 85 percent. | | |
| Total Suspended Solids (TSS) | mg/L | 69[1] | 104[1] | -- | 30 | 45 | -- |
| | lbs/day | 47,187[3] | 71,124[3] | -- | 22,518[4] | 33,777[4] | -- |
| | % Removal | As a monthly average, not less than 60 percent removal efficiency from the influent stream. | | | The average monthly percent removal shall not be less than 85 percent. | | |

1 Effluent limitations contained in the Prior Permit and effective through December 2010. These effluent limitations were replaced with interim effluent limitations in the December 2010 United States of America v. City and County of Honolulu Consent Decree (2010 Consent Decree).
2 Effluent limitations are the same in both the 2014 permit and 2017 permit modification; however, these effluent limitations were replaced with interim effluent limitations in the 2010 Consent Decree.
3 Based on a design flow of 82 MGD.
4 Based on a design flow of 90 MGD.

**Table F-10. Summary of Final Effluent Limitations – All Other Pollutants**

| Parameter | Units | Effluent Limitations Contained in the Prior Permit | | | Effluent Limitations in 2014 Permit[1] ("2014") and Modified Permit ("MP") | | |
|---|---|---|---|---|---|---|---|
| | | Average Annual | Average Monthly | MaximumDaily | Average Annual | Average Monthly | Maximum Daily |
| Enterococci | CFU/100 ml | -- | -- | 18,000 | -- | 2014: 3,605[2] | 2014: 18,000[3] |
| Enterococci | CFU/100 ml | -- | -- | 18,000 | -- | MP: 19,250[2] | MP: 28,730[3] |
| pH[4] | s.u. | Not less than 6.0 and not greater than 9.0 | | | Not less than 6.0 and not greater than 9.0 | | |
| Chronic Toxicity – *Ceriodaphnia Dubia* | TUc | -- | -- | 94 | -- | -- | -- |
| Chronic Toxicity – *Ceriodaphnia Dubia* | TUc | -- | -- | 94 | -- | -- | MP: Pass[6] |
| Chronic Toxicity – *Tripneustes Gratilla*[8] | TUc | -- | -- | [5] | -- | -- | MP: Pass[6] |
| Chronic Toxicity – *Afffnis* | TUc | -- | -- | -- | -- | -- | MP: Pass[6] |
| Dieldrin | µg/L | 0.012 | -- | 0.18 | 2014: 0.0074 | -- | 2014: 0.18 |
| | lbs/day | 0.0082 | -- | 0.12 | 2014: 0.0056 | -- | 2014: 0.14 |
| Dieldrin | µg/L | 0.012 | -- | 0.18 | MP: 0.0138 | -- | MP: 0.42 |
| | lbs/day | 0.0082 | -- | 0.12 | MP: 0.0103 | -- | MP: 0.315 |
| Total Residual Chlorine | µg/L | -- | -- | 64 | -- | -- | --[7] |

1 Subject to the Permittee's Contested Case proceeding and any applicable stay.
2 Effluent limitation expressed as a monthly geometric mean.
3 Effluent limitation expressed as maximum daily geometric mean.
4 Limits remain unchanged from the 2014 Permit.
5 The chronic toxicity discharge limitation of 94 TUc listed in Part A.1 of the Prior Permit does not apply to monitoring results for toxicity tests using *Trypneustes gratilla*.
6 "Pass", as described in section D.2.g of this Fact Sheet.
7 The Prior Permit required the Permittee to monitor total residual chlorine upon initiation of chlorination if the Permittee determined that the appropriate disinfection technology to achieve disinfection is chlorination. In November 2006, the Permittee started using UV disinfection; therefore, this limit is not applicable.
8 Limit of "Pass" remains unchanged from the 2014 Permit to the modified permit, however the applicable IWC has been revised from 0.97 percent to 0.45 percent.

### i. Satisfaction of Anti-Backsliding Requirement

The CWA specifies that a revised permit may not include effluent limitations that are less stringent than the Prior Permit unless a less stringent limitation is justified based on exceptions to the anti-backsliding provisions contained in CWA Sections 402(o) or 303(d)(4), or, where applicable, 40 CFR 122.44(l).

For the enterococcus monthly average effluent limitations, ammonia daily maximum effluent limitations and DDT effluent limitations, there is no backsliding because the limits in the 2014 Permit were challenged and stayed by the Hearings Officer, and no limits for these parameters were contained in the Prior Permit. See EPA's Interim Guidance On Implementation Of Section 402(o) Anti-backsliding Rules For Water Quality-Based Permits.

The removal of the chlordane limit and the changes to dieldrin and enterococcus limits may constitute backsliding. However, CWA 303(d)(4)(B) allows backsliding if it is consistent with the State's anti-degradation policy.

**j. Satisfaction of Antidegradation Requirements**

The DOH established the State antidegradation policy in HAR, Section 11-54-1.1, which incorporates the federal antidegradation policy at 40 CFR 131.12. The State antidegradation policy requires, among other factors, that the existing quality of Tier 2 waters be maintained and protected unless the degradation is necessary to accommodate important economic or social development in the area in which the waters are located. The proposed modification includes an antidegradation analysis that is consistent with DOH policy.

For the enterococcus monthly average effluent limitations, ammonia daily maximum effluent limitations and DDT effluent limitations, there is no degradation or lowering of water quality because the limits in the 2014 Permit were challenged and stayed by the Hearings Officer, and no limits for these parameters were contained in the Prior Permit.

For the chlordane and dieldrin effluent limitations, there is no degradation or lowering of water quality because the discharge is not expected to exceed current concentrations and loading. Specifically, for chlordane, there are no anticipated changes in SIWWTP effluent concentrations; to the applicable treatment operations at SIWWTP related to chlordane; or to SIWWTP's design capacity. As a result, there is no reason to expect increases to chlordane concentrations or loading in the receiving water from the SIWWTP discharge as a result of the permit limit modification. For dieldrin, the average dieldrin effluent concentration over the five-year period between 2012 and 2016 was .0198 µg/L, with an average daily loading of .012 lbs/day. Under the modified permit, the dieldrin concentration limit is .0138 µg/L, with a loading of .010 lbs/day (based on the SIWWTP's 90 MGD design capacity). Because the dieldrin concentration and loading from the discharge will be less than what has historically been discharged, no lowering of water quality will occur. In addition, the receiving water is not impaired for chlordane or dieldrin, and fish tissue and sediment data indicate a lack of significant chlordane or dieldrin impacts from the outfall.

For the enterococcus daily maximum effluent limitations, anti-degradation is addressed because the impact of the proposed modified effluent limitations to receiving waters is *de minimis.* See Geosyntec Technical Memorandum, October 2017 (Appendix 2). See also, 2005 EPA OST Memorandum, Tier 2 Antidegradation Reviews and Significance Thresholds August 2005 ("[t]he intent of tier 2 protection is to maintain and protect high quality waters and not to allow for any degradation beyond a de minimis level without having made a demonstration, with opportunity for public input, that such a lowering is necessary and important"). The Memorandum further states that applying the review requirements "only to those activities that may result in significant degradation of water quality is a useful approach that allows states and tribes to focus their resources where they may result in the greatest environmental protection." (U.S.EPA 2005).

The *1987 Guidance on Implementing the Antidegradation Provisions of 40 CFR 131.12* by EPA Region 9 includes a flow chart which is evaluated below. Based on the flow chart, the modification is consistent with the State's antidegradation policy.

**Antidegradation Flow Chart**

| | **Flow Chart Step** | **Response** |
|---|---|---|
| 1 | ***Will the regulated action lower water quality?***<br>The proposed modification will not lower water quality (see above discussion). | **No** |
| 2 | ***Is the water an Outstanding National Resource Water?***<br>The Pacific Ocean at Outfall 001 is Class A, open coastal, and is not considered an outstanding national resource water. | **No** |
| 3 | ***Is water quality better than necessary to support designated uses?***<br>Receiving water data analyzed in the development of the 2014 Permit determined that there is assimilative capacity in waters surrounding the outfall. | **Yes** |
| 4 | ***Will the action significantly lower water quality?***<br>The proposed modification of the enterococcus daily maximum effluent limitations will not significantly lower water quality (see above discussion). | **No** |
| 5 | ***Will designated uses be fully maintained and protected?***<br>The proposed modification to the effluent limits are based | **Yes** |

| | | |
|---|---|---|
| | on Hawaii's WQS. As long as the permit requirements are adhered to, the receiving water in the vicinity of the discharge should remain in compliance with State water quality standards and therefore designated uses will be fully maintained and protected. | |
| 6 | ***Is action necessary to accommodate economic or social development?***<br>Although water quality will not be lowered or there will only be an insignificant impact to water quality, DOH considered whether the proposed modification is necessary to accommodate important economic or social development in the area in which the waters are located. DOH's evaluation recognizes that the City must move forward in a sustainable manner that considers financial impact on ratepayers and economic and social development within the context of local conditions.<br><br>The context for what is necessary to accommodate important economic and social development for the SIWWTP area includes, significantly, the Global Consent Decree (GCD) that the City entered with EPA, DOH, and other parties in 2010.<br><br>The GCD comprises a financial commitment by Oahu ratepayers that is at the limit of their financial capabilities. The GCD provides for a reasonable work schedule in an orderly manner that was tailored to address Clean Water Act compliance issues regarding the collection system and the Sand Island and Honouliuli WWTPs. It provides for the opportunity to carefully consider alternatives that will make the upgrades as cost effective and as environmentally beneficial as possible.<br><br>Pursuant to the GCD, the City is in the middle of making major upgrades to its collection system this decade. The projected cost for the collection system improvements in 2010 dollars was $3.4 billion. The City also has committed to the installation of secondary treatment and other plant improvements at the Honouliuli Wastewater Treatment Plant by 2024 and at SIWWTP by 2035 (or at least no later than 2038). The plant upgrade costs include detailed design of the facilities to begin in the next few years. These two treatment plant upgrades are currently expected to cost $1.7 billion. The total costs of these GCD upgrades are thus expected to exceed $5 billion.<br><br>In negotiating the 2010 GCD, the City and EPA | **Yes** |

considered that these significant GCD upgrade costs would cause major increases to all sewer rates. Prior to the GCD, the City had already imposed significant rate increases to support its wastewater operating and capital improvement programs. Further rate increases were then required to account for programs consistent with the GCD, in addition to the existing wastewater operating and capital improvement programs. Overall, the average monthly rate has risen more than 350% since 2005. Undoubtedly, future projected rate increases will place an ever-increasing burden on Oahu residents. These cost commitments have major implications for economic and social development in the area, and were considered.

Providing additional supplemental disinfection at the SIWWTP prior to upgrading to secondary treatment is premature and will only create another substantial financial burden upon the community as secondary treatment will improve the quality of the discharge, including substantial (one order of magnitude) reduction in enterococcus levels. This reduction has major implications for the design and construction, and resulting costs, of additional disinfection, if necessary. For example, there are several key variables for UV disinfection design, such as the level of enterococci bacteria in the flow to be treated, that will impact the size, cost, and energy use for any potential facility to be constructed.

Currently, SIWWTP is performing chemically enhanced primary treatment followed by disinfection using dual bank medium pressure ultraviolet disinfection channels. The current disinfection system uses about two (2) million kilowatt hours of electricity per month at a cost of approximately
$6 million per year. Additional costs include approximately $1.5 million per year for system equipment and approximately 5 full time employees to operate and maintain the system.

Given all of these substantial costs, the relatively insignificant degradation of water quality as described above is necessary to accommodate important economic and social development in the area.

Even though the proposed modification is not expected to lower water quality or will have only an insignificant impact

| | | |
|---|---|---|
| | to water quality, DOH evaluated alternatives but found that none were technologically possible, able to be put into practice and economically viable. | |
| 7 | ***Were the highest statutory/regulatory requirements met?*** Regulatory requirements are contained in the modified permit. | **Yes** |

## E. Rationale for Receiving Water and Zone of Mixing Requirements

### 1. Summary of ZOM Water Quality Standards and Monitoring Data

The following are effluent quality monitoring results for HAR, Chapter 11-54, specific water quality criteria parameters that were provided in the ZOM Application on December 21, 2010, and applicable ZOM water quality criteria from 11-54-6(b)(3).

**Table F-11. ZOM Monitoring Data**

| Parameter | Units | Applicable Water Quality Standard | Maximum Reported Concentration[1] |
|---|---|---|---|
| Total Nitrogen | µg/L | 150[2] | 23,302 |
| Ammonia Nitrogen | µg/L | 3.5[2] | 11,900 |
| Nitrate + Nitrite | µg/L | 5.0[2] | 110 |
| Orthophosphate Phosphorus | µg/L | -- | 3,440 |
| Total Phosphorus | µg/L | 20[2] | 2,900 |
| Chlorophyll a | µg/L | 0.30[2] | 0.923 |
| Turbidity | NTU | 0.50[2] | 82.5 |
| TSS | mg/L | -- | 38.7 |
| pH | s.u. | [3] | 7.0 |
| Dissolved Oxygen | mg/L | [4] | 2.38 |
| Temperature | °C | [5] | 26.5 |
| Salinity | ppm | [6] | 7,200 |

1 Source: ZOM Application dated December 21, 2010
2 Water quality standard expressed as a geometric mean.
3 pH shall not deviate more than 0.5 units from a value of 8.1, except at coastal locations where and when freshwater from stream, stormdrain, or groundwater discharge may depress the pH to a minimum level of 7.0.
4 Dissolved oxygen shall not be less than 75 percent saturation.
5 Temperature shall not vary more than 1° Celsius from ambient conditions.
6 Salinity shall not vary more than 10 percent from natural or seasonal changes considering hydrologic input and oceanographic factors.

## 2. Existing Receiving Water Limitations and Monitoring Data

### a. Shoreline Stations

The following are a summary of the geometric mean values calculated from each shoreline monitoring location, reported in the monthly DMRs from January 2009 to December 2013.

**Table F-12. Shoreline Monitoring Stations**

| Station | Geometric Mean[1] |
|---|---|
| | Enterococcus |
| | CFU/100 mL |
| S1 | 7.05 |
| S2 | 2.22 |
| S5 | 7.16 |
| S7 | 4.26 |
| S8 | 10.94 |
| Water Quality Standard | 35 |

1 Source: Monthly DMRs submitted by the Permittee from January 2009 to December 2013.

### b. Nearshore Stations

The following are a summary of the geometric mean values calculated from each near shore monitoring location, reported in the monthly and quarterly DMRs from 2009 through 2013.

**Table F-13. Nearshore Monitoring Stations**

| Station | Highest Annual Geometric Mean[1] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Enterococcus | Nitrate + Nitrite Nitrogen[2] | Ammonia Nitrogen[2] | Total Nitrogen[2] | Total Phosphorus[2] | Turbidity[2] | Chlorophyll a[2] |
| | CFU/100 mL | µg/L | µg/L | µg/L | µg/L | NTU | µg/L |
| R1 | 1.83 | -- | -- | 123 | 14.6 | -- | 1.11 |
| R2 | 1.52 | -- | -- | 121 | 12.0 | -- | 0.91 |
| R3 | 1.97 | -- | -- | 115 | 10.8 | -- | 0.71 |
| C1 | 1.11 | 3.42 | 2.67 | 102 | 8.9 | 0.38 | 0.25 |
| C2 | 1.25 | 3.42 | 3.08 | 102 | 8.8 | 0.35 | 0.29 |
| C3 | 1.25 | 1.82 | 3.47 | 98 | 8.4 | 0.25 | 0.29 |
| C4 | 1.23 | 1.41 | 2.31 | 98 | 8.5 | 0.29 | 0.29 |
| C5 | 1.26 | 2.01 | 2.50 | 99 | 8.4 | 0.35 | 0.31 |
| C6 | 1.14 | -- | -- | -- | -- | -- | -- |
| Water Quality Standard | 35 | 5.0 | 3.5 | 150 | 20 | 0.50 | 0.30 |

1 Source: Monthly and Quarterly DMRs submitted by the Permittee from 2009 through 2013.
2 Reported geometric mean is the maximum geometric mean from the top, middle, and bottom sampling points at each station.

### c. Offshore Stations

The following are a summary of the geometric mean values calculated from each offshore monitoring location on the edge of the ZOM, or reference station, reported in the monthly and quarterly DMRs from 2009 through 2013. The results for ammonia nitrogen were recalculated as previously discussed and represent data from 2014, 2015, and 2016.

**Table F-14. Offshore Monitoring Stations**

| Station[1] | Highest Annual Geometric Mean[2] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Enterococcus | Nitrate + Nitrite Nitrogen[2] | Ammonia Nitrogen[3] | Total Nitrogen[3] | Total Phosphorus[3] | Turbidity[3] | Chlorophyll a[3] |
| | CFU/100 mL | µg/L | µg/L | µg/L | µg/L | NTU | µg/L |
| D1 | 1.30 | 1.62 | 4.8 | 105 | 8.50 | 0.25 | 0.26 |
| D2 | 1.39 | 1.28 | 2.9 | 107 | 8.67 | 0.23 | 0.19 |
| D3A | 1.33 | 1.40 | 3.4 | 119 | 8.72 | 0.21 | 0.22 |
| D4 | 1.33 | 1.15 | 2.5 | 111 | 8.48 | 0.26 | 0.2 |
| E1 | 1.31 | 1.79 | 3.6 | 116 | 8.35 | 0.24 | 0.23 |
| E2 | 1.32 | 1.85 | 2.5 | 110 | 8.75 | 0.27 | 0.17 |
| E3 | 1.35 | 1.62 | 3.0 | 120 | 8.82 | 0.22 | 0.21 |
| E4 | 1.69 | 1.94 | 3.0 | 103 | 8.44 | 0.22 | 0.18 |
| Water Quality Standard | 35 | 5.0 | 3.5 | 150 | 20 | 0.50 | 0.30 |

1 Stations D2, D3A, E2 and E3 are located at the boundary of the ZOM and are subject to RPA. The remaining stations are control stations.
2 Source: Monthly and Quarterly DMRs submitted by the Permittee from 2009 through 2013. The ammonia nitrogen data is from 2014, 2015, and 2016.
3 Reported geometric mean is the maximum annual geometric mean from the top, middle, and bottom sampling points at each station.

## 3. Proposed Receiving Water Limitations

### a. Basic Water Quality Criteria Applicable to the Facility

**(1)** The discharge shall not cause a violation of any applicable water quality standard for receiving waters adopted by the DOH, as required by the Water Quality Act of 1987 (P.L. 100-4) and regulations adopted thereunder. The DOH adopted water quality standards specific for open coastal waters in HAR, Chapter 11-54. The modified permit incorporates receiving water limitations and requirements to ensure the facility does not exceed applicable water quality standards.

**(2)** Mamala Bay is designated as “Class A Wet Open Coastal Waters.” As such, the discharge from the facility shall not interfere with the attainment or maintenance of that water quality which assures protection of public water supplies and the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife and allows recreational activities in and on the water. The modified permit incorporates receiving water limitations for the protection of the beneficial uses of Mamala Bay.

The Permittee is required to comply with the HAR, Chapter 11-54, Basic Water Quality Criteria of which has been incorporated as part of the modified permit under Section 1 of the DOH Standard NPDES Permit Conditions (version 14).

**(3)** The following criteria are included in HAR, Section 11-54-8 for recreational areas in marine recreational waters:

(a) Enterococcus content shall not exceed a geometric mean of 35 colony forming units per one hundred milliliters over any thirty day interval.

(b) A Statistical Threshold Value (STV) of 130 per one hundred milliliters shall be used for enterococcus. The STV shall not be exceeded by more than ten percent of samples taken within the same thirty day interval in which the geometric mean is calculated.

(c) State waters in which enterococcus content does not exceed the standard shall not be lowered in quality.

(d) Raw or inadequately treated sewage, sewage for which the degree of treatment is unknown, or other pollutants of public health significance, as determined by the director of health, shall not be present in natural public swimming, bathing, or wading areas. Warning signs shall be posted at locations where human sewage has been identified as temporarily contributing to the enterococcus count.

The modified permit establishes these criteria for recreational areas, as described in Part C of the modified permit, to be consistent with HAR, Section 11-54-8.

**b. Specific Criteria for "Class A Wet Open Coastal Waters"**

**Table F-15. Specific Criteria for "Class A Wet Open Coastal Waters"**

| Parameter | Units | Geometric mean not to exceed the given value | Not to exceed the given value more than 10% of the time | Not to exceed the given value more than 2% of the time |
|---|---|---|---|---|
| Total Nitrogen | µg/L | 150.00 | 250.00 | 350.00 |
| Ammonia Nitrogen | µg/L | 3.50 | 8.50 | 15.00 |
| Nitrate + Nitrite Nitrogen | µg/L | 5.00 | 14.00 | 25.00 |
| Total Phosphorus | µg/L | 20.00 | 40.00 | 60.00 |
| Light Extinction | k units | 0.20 | 0.50 | 0.85 |

| Parameter | Units | Geometric mean not to exceed the given value | Not to exceed the given value more than 10% of the time | Not to exceed the given value more than 2% of the time |
|---|---|---|---|---|
| Coefficient | | | | |
| Chlorophyll a | µg/L | 0.30 | 0.90 | 1.75 |
| Turbidity | NTU | 0.50 | 1.25 | 2.00 |
| pH | standard units | Shall not deviate more than 0.5 standard units from a value of 8.1, except at coastal locations where and when freshwater from stream, stormdrain, or groundwater discharge may depress the pH to a minimum level of 7.0. | | |
| Dissolved Oxygen | mg/L | Shall not be less than 75 percent saturation, determined as a function of ambient water temperature and salinity. | | |
| Temperature | °C | Shall not vary more than 1°C from ambient conditions. | | |
| Salinity | ppm | Shall not vary more than 10 percent from natural or seasonal changes considering hydrologic input and oceanographic factors. | | |

The specific water quality criteria listed at HAR, Section 11-54-6(b)(3) for "Class A, Wet Open Coastal Waters" shall apply to the treated wastewater through Outfall Serial No. 001, as seen in the table above.

The discharges from Outfall Serial No. 001 shall comply with the values listed in Table F-15 for light extinction coefficient, turbidity, and dissolved oxygen at the edge of the ZID and shall comply with water quality standards for all other pollutants listed in Table F-15 beyond the ZOM.

These requirements are consistent with HAR, Chapter 11-54, and retained from the Prior Permit.

### c. Zone of Initial Dilution (ZID) and Zone of Mixing (ZOM)

Federal regulations at 40 CFR 125.62(a) require that at the time a 301(h) modification becomes effective, the Permittee's outfall and diffuser must be located and designed to provide adequate initial dilution, dispersion, and transport of wastewater such that the discharge does not exceed, at and beyond the ZID, all applicable State water quality standards and, for pollutants for which there are no EPA-approved standards. EPA's Amended Section 301(h) Technical Support Document (1994) describes the ZID as the area around the diffuser circumscribed by the distance "d" from any point of the diffuser, where "d" is equal to the water depth. The ZID dimensions for the Facility as defined in EPA's TDD are 469.5 feet wide and 3,860.2 feet along the centerline of the diffuser.

HAR, Chapter 11-54 allows for a ZOM, which is a limited area around outfalls to allow for initial dilution of waste discharges, if the ZOM is in compliance with requirements in HAR, Section 11-54-9(c). For the 2014 Permit renewal, the Permittee requested that the existing ZOM for the assimilation of treated wastewater from the Mamala Bay be retained. Consistent with the current permit, the ZOM requested is 1,400 feet wide and 4,800 feet along the centerline of the diffuser, and extends vertically downward to the ocean floor. The center of the ZOM is located at Latitude 21°16’58”N and Longitude 157°54’21”W, with the major axis located on the azimuth of 80° 01’ 40” from the south. Figure 2 in the modified permit shows the ZOM and ZID.

(1) Prior to the renewal of a ZOM, the environmental impacts, protected uses of the receiving water, existing natural conditions, character of the effluent, and adequacy of the design of the outfall must be considered. The following findings were considered:

(a) The Permittee’s ZOM application indicates that annual analysis of the effects on the receiving waters, benthic sediment grain size distribution and a Mamala Bay Study indicate that no major physical effects are expected due to the continuation of the ZOM.

Data from 2000 through 2010 summarized in the Permittee’s 2010 Fish Monitoring Report shows fish abundance and distribution fluctuate in the outfall vicinity through different years, but does not show any long term trends between fish catches and the discharge from the outfall.

An additional study conducted in 1998 using a remotely controlled video camera system to document fish near the diffuser from 1991 through 1997 indicate that the number of fish species identified has not been negatively impacted.

Historical reports (1995, 1996, and 2005) on necropsy of liver histopathology findings for fish sampled from a control station in Maunalua Bay and the Sand Island Outfall conducted by the Department of Land and Natural Resources indicate no gross or microscopic pathologic changes observed which would indicate the sewage discharged at the Sand Island Municipal Outfall had an impact on the health of the fish studied in the survey.

Based on the limited data and studies, there is no current evidence that the outfall or the existing ZOM is adversely impacting fish health or community structure.

(b) The diffuser for Outfall Serial No. 001 reportedly provides a minimum of 221:1 dilution and discharges approximately 9,000 feet offshore. No information provided in the ZOM application indicates that dilution would be negatively impacted by current conditions.

(c) Effluent data and receiving water data are provided in Tables F-8, F-11, F-12, F-13, and F-14 of this Fact Sheet. As discussed above, biological monitoring of the Facility's diffuser found that no evidence of negative impacts to fish populations due to the diffuser were identified.

(2) HAR, Section 11-54-9(c)(5) prohibits the establishment of a ZOM unless the application and supporting information clearly show: that the continuation of the ZOM is in the public interest; the discharge does not substantially endanger human health or safety; compliance with the WQS would produce serious hardships without equal or greater benefits to the public; and the discharge does not violate the basic standards applicable to all waters, will not unreasonably interfere with actual or probable use of water areas for which it is classified, and has received the best degree of treatment or control. The following findings were made in consideration of HAR, Section 11-54-9(c)(5):

(a) The Facility treats domestic wastewater from the southern to southeastern portion of the Island of Oahu, serving ~460,000 people and is a necessity for public health. There are no other treatment facilities currently servicing this area and a cessation of function or operation would cause severe hardship to the residents.

(b) No known information indicates that the discharge is causing or contributing to conditions that substantially endanger human health or safety. The Permittee reports there have been no reported cases of illness which health officials attributed to the treated effluent and that enterococcus bacteria data does not indicate a shoreward movement of the effluent discharged 9,000 feet offshore.

(c) The feasibility and costs to install treatment necessary to meet applicable WQS end-of-pipe, or additional supporting information, were not provided by the Permittee to demonstrate potential hardships. However, based on effluent data, significant Facility enhancements and capital costs would likely be necessary to comply with applicable WQS for which the ZOM was applied. As discussed in Part E.3.c.(2)(a), the operation of the Facility has been found to benefit the public. No information is known that would revise the finding during the Prior Permit term that compliance with the applicable WQS without a ZOM would produce serious hardships without equal or greater benefits to the public.

(d) The Permit requires compliance with the effluent limitations and conditions which are protective of the actual and probable uses of the receiving water and implement applicable technology-based effluent limitations.

The Department has determined that the ZOM satisfies the requirements in HAR, Section 11-54-09(c)(5).

Based on the finding that the ZOM satisfies the applicable requirements, pollutants for which a ZOM has been previously approved will retain the ZOM. These pollutants include total nitrogen, ammonia nitrogen, nitrate + nitrite nitrogen, total phosphorus, chlorophyll a, pH, temperature, and salinity.

For receiving water limitations previously not granted a ZOM, the applicable water quality standards must be met at that ZID. These pollutants include light extinction coefficient, turbidity, and dissolved oxygen. In EPA's TDD, EPA concluded that the discharge would consistently attain the Hawaii water quality standard for dissolved oxygen, turbidity, and light extinction coefficient. As such, the cost of establishing individual receiving water monitoring locations for these parameters along the ZID is not warranted. Consistent with the approach in the Prior Permit, monitoring for dissolved oxygen, turbidity, and light extinction coefficient shall be conducted at the ZOM stations.

The establishment of the ZID and ZOM is subject to the conditions specified in Part D of the modified permit. The modified permit incorporates receiving water monitoring requirements which the DOH has determined are necessary to evaluate compliance of the Outfall Serial No. 001 discharges with the applicable water quality criteria, as described further in Section F.4 of this Fact Sheet.

## F. Rationale for Monitoring and Reporting Requirements

40 CFR 122.41(j) specify monitoring requirements applicable to all NPDES permits. HAR, Section 11-55-28 establishes monitoring requirements applicable to NPDES permits within the State of Hawaii. 40 CFR 122.48 and HAR, Section 11-55-28 require that all NPDES permits specify requirements for recording and reporting monitoring results. The principal purposes of a monitoring program are to:

- Document compliance with waste discharge requirements and prohibitions established by the DOH;
- Facilitate self-policing by the Permittee in the prevention and abatement of pollution arising from waste discharge;
- Develop or assist in the development of limitations, discharge prohibitions, national standards of performance, pretreatment and toxicity standards, and other standards; and,
- Prepare water and wastewater quality inventories.

The modified permit establishes monitoring and reporting requirements to implement federal and State requirements. The following provides the rationale for the monitoring and reporting requirements contained in the modified permit.

**1. Influent Monitoring**

Influent monitoring is required to determine the effectiveness of pretreatment and non-industrial source control programs, to assess the performance of treatment facilities, and to evaluate compliance with effluent limitations. All influent monitoring requirements have been retained from the Prior Permit, except for chlordane. The proposed influent water monitoring requirements are specified in Part A.1 of the modified permit.

**2. Effluent Monitoring – Outfall Serial No. 001**

The following monitoring requirements are applicable at Outfall Serial No. 001.

a. Monitoring requirements for total nitrogen and total phosphorus are retained from the Prior Permit to enable comparison with the receiving water ZOM monitoring results to determine if the facility effluent is contributing to elevated concentrations of said pollutants.

b. Monitoring requirements for ammonia nitrogen have been added to the modified permit to enable comparison with the receiving water ZOM monitoring results to determine if the facility effluent is contributing to elevated concentrations of ammonia nitrogen. Monitoring requirements are consistent with monitoring requirements for other nutrients.

c. Monitoring requirements for nitrate + nitrite nitrogen and turbidity have been added to the modified permit to enable comparison with the receiving water ZID monitoring results to determine if the facility effluent is contributing to elevated concentrations of nitrate +nitrite nitrogen and turbidity.

d. Monitoring requirements for flow have been retained from the Prior Permit to calculate pollutant loading and to determine compliance with mass-based effluent limitations.

e. Monitoring requirements for temperature have been retained from the Prior Permit to determine compliance with water quality standards.

f. Monitoring requirements for pH, $BOD_5$, dieldrin, enterococcus, and TSS have been retained from the Prior Permit in order to determine compliance with effluent limitations and to collect data for future RPAs.

g. Monitoring requirements for total oil and grease; total petroleum hydrocarbons; and fats, oils, and grease have been retained from the Prior

Permit to ensure that the facility is meeting the basic water quality criteria contained in HAR, Section 11-54-4(a), which states all waters shall be free of "Floating debris, oil, grease, scum, or other floating materials," and in the DOH's Standard NPDES Permit Conditions (Version 14), which is included as an attachment to the modified permit.

h. Monitoring requirements for all other pollutants listed in Appendix 1 are retained from the Prior Permit in order to collect data for future RPAs.

**3. Whole Effluent Toxicity Monitoring**

Consistent with the Prior Permit, monthly whole effluent toxicity testing is required in order to determine compliance with whole-effluent toxicity effluent limitations as specified in Parts A.1 and B of the modified permit.

**4. Receiving Water Quality Monitoring Requirements**

**a. Shoreline Water Quality Monitoring**

Shoreline water quality monitoring for enterococci is used to determine compliance with water quality criteria specific for marine recreational waters within 300 meters (1,000 feet) of shoreline, as described in Part C.1 of the modified permit. The Permittee shall monitor at five stations with a frequency of seven (7) days per month in order to calculate a geometric mean. These monitoring requirements are retained from the Prior Permit and included in Part E.1 of the modified permit.

**b. Nearshore Water Quality Monitoring**

Nearshore water quality monitoring is required to determine compliance with State water quality standards, as described in Part C.2 of the modified permit. The modified permit requires the Permittee to monitor recreational waters at three (3) stations, R1 through R3. Although these stations are called recreational waters, they are beyond 300 meters (1,000 feet) from shore and, therefore, monitoring at these stations is not intended for compliance with specific water quality criteria for recreational areas in Part C of the modified permit.

In addition to station R1 through R3, the modified permit requires the Permittee to also monitoring nearshore waters at five stations: C1A, C2A, C3A, C4 and C5A. The Prior Permit required the Permittee to monitor at stations C1, C2, C3, and C5 rather than C1A, C2A, C3A, and C5A. These stations have been amended from the Prior Permit because the old stations did not have sufficient benthic material. The new stations are in the same vicinity as the old stations. All other monitoring requirements for the nearshore stations are retained from the Prior Permit and included in Part E.2 of the modified permit.

Further, receiving water monitoring is necessary to evaluate the impact of the discharge on the receiving water, consistent with Section 403(c) of the CWA.

**c. Offshore Water Quality Monitoring**

Offshore water quality monitoring is required to determine compliance with State water quality standards, as described in Part C.2 of the modified permit. The modified permit requires the Permittee to monitor offshore waters at five stations along the 50 meter (165 foot) contour, D1 through D5, and five stations along the 100 meter (328 foot) contour, E1 through E5. All monitoring requirements for offshore stations are retained from the Prior Permit and included in Part E.3 of the modified permit.

Further, receiving water monitoring is necessary to evaluate the impact of the discharge on the receiving water, consistent with Section 403(c) of the CWA.

**d. Nearshore and Offshore Sediment Monitoring**

Nearshore and offshore sediment monitoring is required to detect spatial and temporal trends in sediment pollutants and benthic organisms. The modified permit requires the Permittee to monitor nearshore and offshore sediments for chemistry and benthic organisms at the following stations:

| Location | Station Name | Number of Samples at Each Station (Including Replicates) | |
|---|---|---|---|
| | | Chemistry | Benthic Organisms |
| Nearshore | C1A | 2 | 3 |
| | C2A | 2 | 3 |
| | C3A | 2 | 3 |
| | C5A | 2 | 3 |
| Offshore | D1 | 2 | 3 |
| | D2 | 2 | 3 |
| | D3A | 2 | 3 |
| | D5 | 2 | 3 |
| | E1 | 1 | 3 |
| | E2 | 1 | 3 |
| | E3 | 1 | 3 |
| | E5 | 1 | 3 |

The Prior Permit also required monitoring at Stations C4, D4, and E4. However, Stations C4, D4, and E4 do not have sufficient sand to sample sediment. Therefore, these monitoring stations have not been retained from the Prior Permit. All other nearshore and offshore sediment monitoring requirements have been retained from the Prior Permit.

Further, receiving water monitoring is necessary to evaluate the impact of the discharge on the receiving water, consistent with Section 403(c) of the CWA.

**e. Fish Monitoring**

Fish monitoring is required at three locations, at the outfall and at two (2) fish monitoring stations (FR3 and FR4), to determine if fish are being negatively affected by effluent discharged at Outfall Serial No. 001 compared to the control stations. The Prior Permit required fish tissue to be monitored at FR1 and FR2. The modified permit requires fish tissue to be monitored at the outfall and at control stations FR3 and FR4, instead of control stations FR1 and FR2 established in the Prior Permit. The new control stations are located southwest and west of Oahu. During the term of the Prior Permit, crews collecting samples at FR1 and FR2 have reported difficulty due to strong winds and rough seas. The new stations are being established to enhance the safety of the crew collecting the samples. In addition, recent data collected from around the outfall have indicated no problems when compared to the existing control stations. Therefore, collecting fish at the new control stations will continue to allow comparison to Hawaii fish away from Outfall Serial No. 001. All other fish tissue monitoring requirements have been retained from the Prior Permit.

Further, receiving water monitoring is necessary to evaluate the impact of the discharge on the receiving water, consistent with Section 403(c) of the CWA.

**f. Assimilative Capacity and Zone of Mixing Confirmation Study**

The Permittee is required to conduct a study evaluating the assimilative capacity as specified in Part E.6 of the permit to confirm dilution remains applicable for nutrients for evaluating reasonable potential at the edge of the ZOM during future permitting efforts.

## G. Rationale for Provisions

### 1. Standard Provisions

The Permittee is required to comply with DOH Standard NPDES Permit Conditions, which are included as part of the modified permit.

### 2. Monitoring and Reporting Requirements

The Permittee shall comply with all monitoring and reporting requirements included in the modified permit and in the DOH Standard NPDES Permit Conditions.

## 3. Special Provisions

### a. Reopener Provisions

The modified permit may be modified in accordance with the requirements set forth at 40 CFR 122 and 124, to include appropriate conditions or limitations based on newly available information, or to implement any new state water quality criteria that are approved by the EPA.

### b. Special Studies and Additional Monitoring Requirements

**(1) Toxicity Reduction Requirement.** The modified permit requires the Permittee to submit an initial investigation Toxicity Reduction Evaluation (TRE) workplan to the Director and EPA which shall describe steps which the Permittee intends to follow in the event that toxicity is detected. This requirement is retained from the Prior Permit and is discussed in detail in Part B.5 of the modified permit.

## 4. Special Provisions for Municipal Facilities

### a. Pretreatment Requirements

The federal CWA Section 307(b), and federal regulations, 40 CFR 403, require POTWs to develop an acceptable industrial pretreatment program. A pretreatment program is required to prevent the introduction of pollutants which will interfere with treatment plant operations or sludge disposal, and prevent pass through of pollutants that exceed water quality objectives, standards or permit limitations. Pretreatment requirements are imposed pursuant to CWA Sections 307(b), (c), (d), and 402(b), 40 CFR 125, 40 CFR 403, and in HAR, Section 11-55-24.

The Permittee's pretreatment program was submitted to EPA in 1979 and received approval on July 29, 1982. The Permittee submitted a revised program on June 9, 1994 but no formal approval was issued. On October 16, 1998, the Permittee further streamlined its program. There are currently six non-categorical significant industrial users.

The modified permit includes a pretreatment program in accordance with federal regulations and State pretreatment regulations. The pretreatment requirements are based on Prior Permit and are consistent with NPDES permits issued to other Hawaii POTWs. The modified permit also continues to require the Permittee to implement and update its BMP-based program for controlling animal and vegetable oil and grease.

Large applicants for a modified NPDES permit under section 301(h) of the CWA with a service population greater than 50,000 that receives one or more toxic pollutants from an industrial source are required to comply with urban area pretreatment requirements at 40 CFR 125.65. The modified permit requires the Permittee to comply with urban area pretreatment requirements since the facility continues to operate as a primary treatment plant.

**b. Biosolids Requirements**

The use and disposal of biosolids is regulated under federal laws and regulations, including permitting requirements and technical standards included in 40 CFR 503, 257, and 258. The biosolids requirements in the modified permit are in accordance with 40 CFR 257, 258, and 503, are based on the Prior Permit and are consistent with NPDES permits issued to other Hawaii POTWs.

**5. Other Special Provisions**

**a. Water Pollution Control Plan.** The modified permit requires the Permittee to submit a wastewater pollution control plan by March 31 each year. This provision is retained from the Prior Permit and is required to allow DOH to ensure that the Permittee is operating correctly and attaining maximum treatment of pollutants discharged by considering all aspects of the wastewater treatment system. This provision in included in Part F of the modified permit.

**b.** Wastewater treatment facilities subject to the modified permit shall be supervised and operated by persons possessing certificates of appropriate grade, as determined by the DOH. If such personnel are not available to staff the wastewater treatment facilities, a program to promote such certification shall be developed and enacted by the Permittee. This provision is included in the modified permit to assure that the facility is being operated correctly by personnel trained in proper operation and maintenance. This provision is retained from the Prior Permit and included in Part J.1 of the modified permit.

**c.** The Permittee shall maintain in good working order a sufficient alternate power source for operating the wastewater treatment and disposal facilities. This provision is retained from the Prior Permit in order to ensure that if a power failure occurs, the facility is well equipped to maintain treatment operations until power resumes. If an alternate power source is not in existence, the modified permit requires the Permittee to halt, reduce, or otherwise control all discharges upon the reduction, loss, or failure of the primary source of power. This provision is included in Part J.2 of the modified permit.

## H. Public Participation

In accordance with HAR, Sections 11-55-09(b) and 11-55-09(d), a public notice soliciting comments regarding the proposed modifications was published in the

Honolulu Star-Advertiser on May 1, 2018. Comments were accepted for 30 days following the publication of the notice. The CWB received comments from one organization, the Environmental Protection Agency, Region 9. The comments were addressed in the Response to Comments document.

A public hearing was not requested and was not held.

## Appendix 1 Brown and Caldwell Sand Island Dilution Study dated June 30, 2017

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# Technical Memorandum

Prepared for: City and County of Honolulu

**Technical Memorandum**

| | |
|---|---|
| Subject: | Sand Island Wastewater Treatment Plant Ocean Outfall<br>Dilution Analysis |
| Date: | June 29, 2017 |
| To: | Ross Tanimoto, P.E., Deputy Director<br>City and County of Honolulu, Department of Environmental Services |
| From: | Peter Ono, P.E. |
| Copy to: | Clifton Bell, Brown and Caldwell<br>Philip Roberts, Ph.D. |

Prepared by: William K. Faisst
William K. Faisst, Ph.D., Vice President

Prepared by: Philip J.W. Roberts
Philip J.W. Roberts, Ph.D.

Reviewed by: Peter R. Ono
Peter Ono, P.E.

*Limitations:*

*This document was prepared solely for the City and County of Honolulu in accordance with professional standards at the time the services were performed and in accordance with the contract between the City and County of Honolulu and Brown and Caldwell dated June 30, 2016. This document is governed by the specific scope of work authorized by the City and County of Honolulu; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City and County of Honolulu and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.*

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## List of Abbreviations

| | |
|---|---|
| $\sigma_t$ | one thousandth of a $g/cm^3$, or 1 $kg/m^3$ |
| μg/L | microgram(s) per liter |
| % | percent |
| ADCP | acoustic Doppler current profiler |
| ºC | degree(s) Celsius |
| CCH | City and County of Honolulu |
| cm | centimeter(s) |
| CTD | conductivity, temperature, and depth |
| DOH | State of Hawaii, Department of Health |
| erf | standard error function |
| ft | feet |
| $g/cm^3$ | gram(s) per cubic centimeter |
| km | kilometer(s) |
| m | meter(s) |
| MLLW | mean lower low water |
| NPDES | National Pollutant Discharge Elimination System |
| ppt | part(s) per thousand |
| psu | practical salinity unit |
| s | second(s) |
| TM | Technical Memorandum |
| WWTP | Wastewater Treatment Plant |
| ZID | zone of initial dilution |
| ZOM | zone of mixing |

## Section 1: Executive Summary

This technical memorandum (TM) presents results from dilution analyses for the discharge from the City and County of Honolulu (CCH) Sand Island Wastewater Treatment Plant (SIWWTP) (National Pollutant Discharge Elimination System-NPDES-Permit No. HI 0020117), carried out by Brown and Caldwell with assistance from Dr. Philip Roberts. Table ES-1 presents statistically-derived dilution estimates. The work presented in this TM examined predicted dilution for all discharges and separately for dilution achieved only for discharges that rose into the top 40 meters (131 feet) of the water column. Predicted dilutions for the latter case are significantly higher since more mixing in receiving waters occurs during the longer buoyant rise time.

**Table ES-1. Predicted Dilutions**

| Description | Notes | Dilution | |
|---|---|---|---|
| | | Whole water column | Upper 40 m of water column |
| Minimum dilution at ZID | Ten percentile value of dilution at peak flow | 221 | 624 |
| Average dilution at ZID | Geometric mean dilution at design flow | 550 | 943 |
| Minimum dilution at ZOM including far field diffusion but no bacterial decay | Ten percentile value of dilution at peak flow | 225 | 634 |
| Average dilution at ZOM including far field diffusion but no bacterial decay | Geometric mean dilution at design flow | 560 | 961 |
| Minimum dilution at ZOM including far field diffusion and bacterial decay | Ten percentile value of dilution at peak flow | 247 | 711 |
| Average dilution at ZOM including far field diffusion and bacterial decay | Geometric mean dilution at design flow | 616 | 1084 |

## Section 2: Introduction

At the direction of the CCH Department of Environmental Services, Brown and Caldwell, with technical support from Dr. Philip Roberts, prepared this dilution study TM for the SIWWTP (NPDES Permit No. HI 0020117) and effluent outfall.

## Section 3: Dilution Modeling Approach and Assumptions

This section describes and discusses dilution calculations as required for the SIWWTP NPDES permit and ocean outfall. This TM presents modeling carried out using the most appropriate available data. We present dilution analyses for the zone of initial dilution (ZID), defined as where the near-field mixing is completed and the Zone of Mixing (ZOM) defined in the permit as extending 700 ft (213 m) from the diffuser. We completed numerical simulations using field-measured density stratification for five years, 2012 – 2016.

Figure 3-1 illustrates the basic processes under consideration schematically. For the Sand Island discharge, a multiport diffuser ejects wastewater effluent horizontally as round turbulent jets. Because the density of domestic sewage is close to that of fresh water, it is very buoyant in seawater. The jets therefore begin rising toward the surface and may merge with adjacent jets as they rise. The turbulence and entrainment induced by the jets causes rapid mixing and dilution. The region in which this mixing occurs is called the “near field” or “initial mixing region.” If strong enough, oceanic density stratification may trap the rising plumes below the water surface; at that point the effluent field stops rising and begins to spread laterally. The effluent field then drifts with the ocean current; oceanic turbulence diffuses it and dilutes it further in a region called the "far field." The mixing rate, or increase of dilution, occurs much more slowly in the far field than in the near field. In addition, Enterococcus contained in the effluent die off due primarily to exposure to sunlight as the plume drifts in the far field.

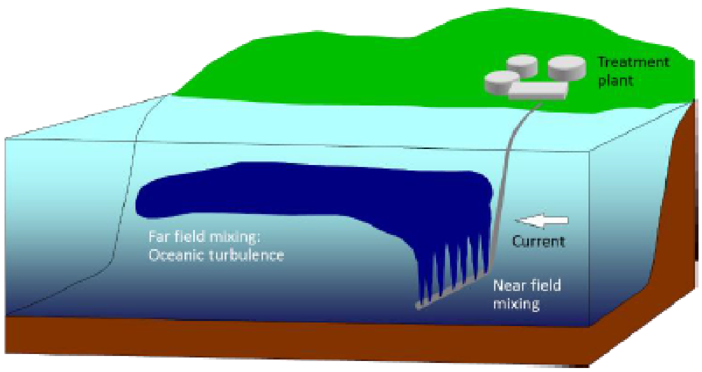



**Figure 3-1. Typical behavior of wastewater discharged from an outfall into coastal waters**

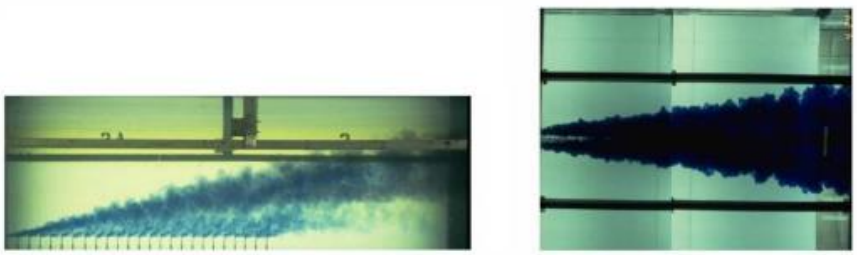
*From Roberts, et al. (2010).*

Near field mixing caused by the discharge buoyancy and momentum occurs over distances of 10 to 1,000 m and times of a few minutes. Far field mixing, transport by ocean currents and diffusion by oceanic turbulence, occurs over distances of 10 m to 10 km and time scales of 1 to 20 hours.

## 3.1 Near Field Model

For this study we used NRFIELD, which is a part of the latest version of Visual Plumes. NRFIELD was specifically developed for effluent discharges into marine environments from multiport diffusers. It originally was based on the extensive experiments on multiport discharges into flowing density-stratified environments by Roberts, Snyder, and Baumgartner (1989abc), hence its original name of RSB. It has since been continually updated as reported in Tian et al. (2003, 2004) and others. Following the updates, and because it emphasizes the flow properties at the end of the near field, it was renamed NRFIELD. Since it was designed specifically for conditions typical of very buoyant discharges of domestic effluent from multiport diffusers into stratified oceanic waters, we selected NRFIELD as the most appropriate model for modeling discharges through the Sand Island Ocean Outfall. Data from field testing have verified NRFIELD performance, for example Hunt et al. (2010). In field tests of the Hilo, Hawaii, outfall (Brown and Caldwell, 2005), NRFIELD gave dilution predictions that agreed well with field measurements. It accounts for discharges from both sides of the diffuser and varying current directions relative to the diffuser ranging from perpendicular to parallel. NRFIELD incorporates receiving water density stratifications and it includes the lateral spreading after the terminal rise height and subsequent turbulent collapse that occurs at the near field end.

Laboratory photographs presented in Figure 3-2 illustrate the essential physical processes modeled for a buoyant discharge from a multiport diffuser into a flowing current parallel to the diffuser. We show the parallel current case because a parallel current is present at the Sand Island diffuser. Buoyant effluents rise in the water column and are either trapped by the ambient density stratification if it is strong enough, or reach the water surface if it is weak. The plumes from individual ports are swept downstream and merge as they rise; when they reach the terminal rise height they spread laterally in a V-shape. As the current speed increases the rise height and the spreading angle decrease, dilution increases, and the distance to the end of the near field increases. NRFIELD incorporates these effects. The plume may overshoot before settling down to its final equilibrium level, sometimes referred to as the "second trap level." The State of Hawaii, Department of Health (DOH) guidelines specify that the second trap level be used in the ZID dilution calculations; NRFIELD automatically predicts dilutions at this level, which corresponds to the end of the near-field processes.



a) Side view b) Overhead view

**Figure 3-2. Trapped buoyant plume from a multiport diffuser into a flowing stratified current parallel to the diffuser**

*From Roberts, et al. (1989).*

The primary outputs from NRFIELD are the minimum dilution, the plume rise height, and wastefield thickness at the end of the near field as illustrated in Figure 3-3. The near field is defined as the region where mixing is caused by turbulence and other processes generated by the discharge itself, i.e., the buoyancy and momentum of the discharge (Roberts et al. 2010). For further discussion, see Doneker and Jirka (1999), and Roberts (1999). Thus, the near-field definition is consistent with the definition of the ZID in the DOH Dilution Model Guidance that states: "Dilution at the ZID is the level of mixing when jet and buoyant mixing (near field processes) are complete." Following completion of the near field processes, the plume drifts with the ocean current and is diffused by oceanic turbulence in the far field.

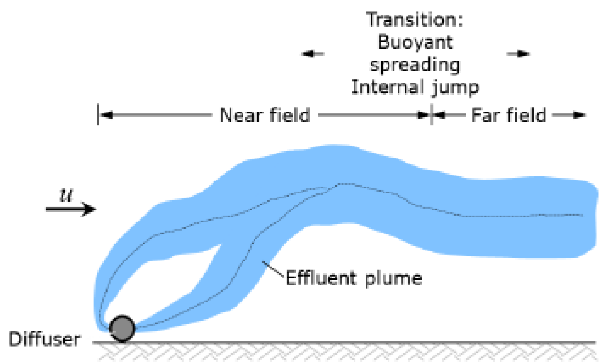



**Figure 3-3. Trapped buoyant plume from multiport diffuser in stationary and flowing stratified environments**

*From Roberts et al. (1989).*

## 3.2 Far Field Diffusion and Bacterial Decay

For this TM we have taken the distance of the ZOM from the diffuser as 700 feet (213 m) per the permit.

The far-field diffusion from the ZID to the ZOM is predicted by Brooks' (1959) solution to the diffusion equation assuming the 4/3 power law of diffusion:

$$\varepsilon = \alpha L^{4/3}$$

where ε is the diffusion coefficient, α is a constant, and *L* is the diffuser length. The far field dilution $S_f$, is given by (Roberts, 1999a):

$$S_f = \left[ erf\left( \frac{3/2}{\left(1+8\alpha L^{-2/3} t\right)^3 - 1} \right)^{1/2} \right]^{-1}$$

where *t* is the travel time from the diffuser to the ZOM and *erf* is the standard error function.

Fischer, et al. (1979) quote values of α in the range of 0.002 to 0.01 $cm^{2/3}/s$. The higher values are appropriate for the early stages of diffusion beyond the near field so for the analyses presented in this TM, the value of α is taken to be 0.01 $cm^{2/3}/s$.

Bacterial decay is modeled as a first-order decay process:

$$\frac{c}{c_o} = 10^{-\frac{t}{T_{90}}}$$

where $c_o$ is the bacterial concentration after completion of near field mixing, $c$ the bacterial concentration after travel time $t$ and $T_{90}$ is a decay rate expressed as the time for 90% reduction in bacteria due to mortality.

The decay rate depends on solar intensity and so is lower for a submerged field than for one at the surface. Landry, et al. (1996) made measurements to simulate the decay of E. coli and Enterococcus at various levels of light intensity in Hawaiian waters. The decay rates of E. coli and Enterococcus were similar and are discussed in Roberts (1999a). For near-surface light conditions, the average decay rate was $T_{90}$ = 9.7 hours. The lowest light level tested was 3 percent of surface light, for which the average decay rate was $T_{90}$ = 24.1 hours. Hence, in the following analyses we assume $T_{90}$ = 9.7 hours for a surfacing effluent field and $T_{90}$ = 24.1 hours for a submerged effluent field.

The combined dilution due to far field mixing and bacterial decay is the product of the far-field dilution $S_f$ and the effective dilution due to decay, which is equal to $c_o/c$. The above equations show that both factors depend solely on the travel time from the ZID to the ZOM. They will be higher for slow current speeds and lower for high current speeds. The ZOM dilution results were weighted per the frequency of current speeds and the dilution and plume submergence within each current speed range.

## 3.3 Outfall Description

Figure 3-4 shows the Sand Island ocean outfall and the local bathymetry. The outfall diffuser is in a water depth of 225 to 235 ft below mean sea level and is located about 9,120 feet (2,780 m) from the shoreline. The diffuser consists of three sections with diameters of 84 inches, 66 inches, and 48 inches (2.13, 1.68, and 1.22 m, respectively). The computed diffuser length is 3,384 ft (1031.4 m). It has 284 ports in total of varying diameters consisting of: 46 - 3.00 inch ports, 90 – 3.18 inch, 74 - 3.34 inch, 72 - 3.53 inch and two offshore end ports 7-inches in diameter. The ports along the diffuser are in port pairs spaced 24 feet (7.32 m) apart. Due to the varying port sizes, the diffuser was set up in NRFIELD as follows: 284 total ports in opposing pairs at 24 feet (7.32 m) spacing with an equivalent port diameter of 3.33-inches (0.085 m) to maintain total port area and therefore, the jet momentum flux, at an average depth of 230 ft (70.1 m). Based on the record drawings the orientation of the diffuser axis is taken as 89° clockwise from north.

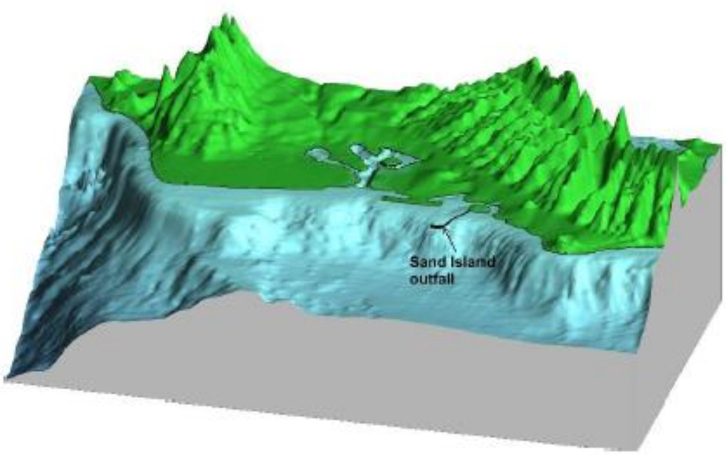



**Figure 3-4. Sand Island Ocean Outfall and local bathymetry.**

## 3.4 Oceanographic Data

A CCH consultant measured currents with an Acoustic Doppler Current Profiler (ADCP) located near the diffuser on the 230-ft depth contour. Measurements were taken from January 22, 2007 through April 19, 2009 with data recorded at 20-minute intervals in 21 bins spaced 3.0 m apart vertically.

Figure 3-5 shows a representative polar scatter diagram of the currents from the bin at a depth of 35 m, near to mid-depth, for January 22, 2007 through May 7, 2007, superimposed on a map of the outfall and diffuser. For this period, reported speeds range from zero to 75 centimeters per second (cm/s). The average speed is 14 cm/s. The predominant currents flowed along an axis oriented at 90° clockwise from North, almost parallel to the orientation of the diffuser axis (the first principal component axis, shown in blue). The currents have a significant semi-diurnal component and reverse with the tide. As summarized in Table 3-1, we extracted the frequency distribution of speeds from the data in 10 groupings or bins, with percent occurrence as shown.

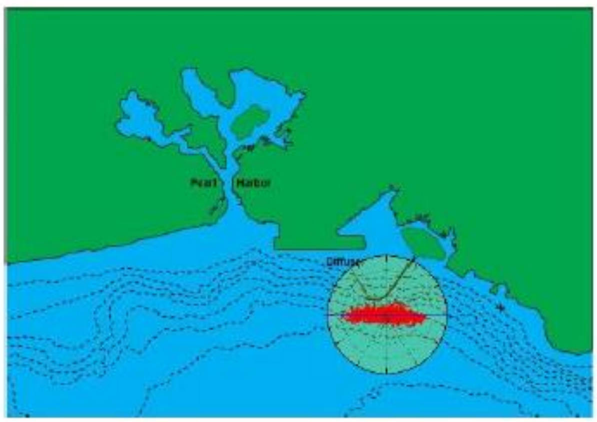



**Figure 3-5. Polar scatter diagram of ADCP currents at mid-depth. The outer circumference is 80 cm/s and the blue line is the first principal component axis.**

**Table 3-1. Frequency distribution of current speeds at mid-depth used for dilution modeling**

| Simulated speed (cm/s) | Speed range (cm/s) | Frequency of occurrence (%) |
|---|---|---|
| 2.5 | 0-4.9 | 18 |
| 7.5 | 5-9.9 | 25 |
| 12.5 | 10-14.9 | 20 |
| 17.5 | 15-19.9 | 14 |
| 22.5 | 20-24.9 | 10 |
| 27.5 | 25-29.9 | 6 |
| 32.5 | 30-34.9 | 3 |
| 37.5 | 35-39.9 | 2 |
| 42.5 | 40-44.9 | 1 |
| 47.5 | >45 | 1 |
| | Total | 100 |

CCH has collected quarterly CTD profiles beginning in January 1995 near the diffuser at the locations shown in Figure 3-6. CCH made measurements at one meter intervals at depths down to about 100 m. The off-shore stations are labeled D1 through D5 and E1 through E5. To illustrate the variability of the density profiles, Figure 3-7 presents plots for all profiles measured at stations E1 through E5 for the past five years (2012 to 2016) down to the diffuser depth of 70.1 m (230 feet, the modeled diffuser depth).

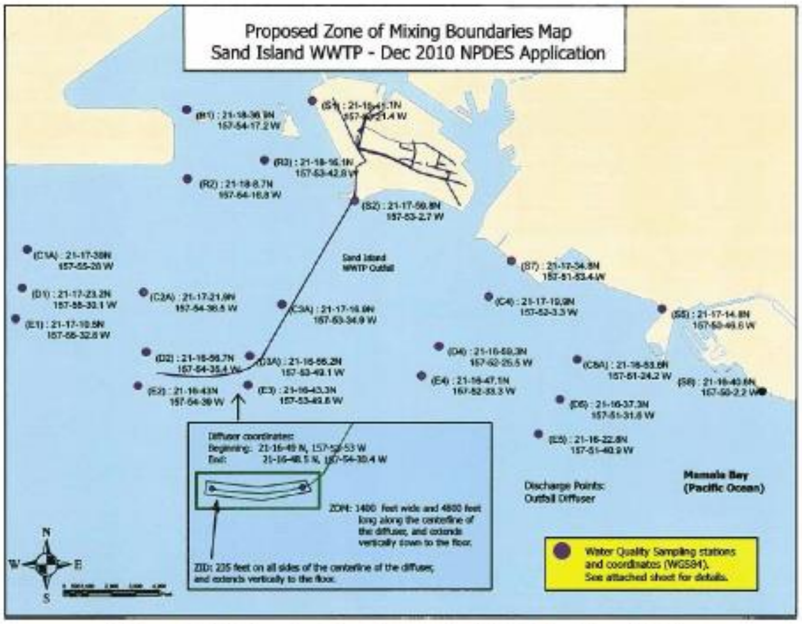



Figure 3-6. Station locations for quarterly CCH density profiling.

The quarterly profiles generally show variable stratification. Density differences over the water column down to the diffuser level range from zero (well mixed) to 2.1 $\sigma_t$ (strongly stratified) (one $\sigma_t$ is one thousandth of a $g/cm^3$, or 1 $kg/m^3$). The 10-percentile density difference is 0.04 $\sigma_t$ and the median density difference is 0.44 $\sigma_t$.

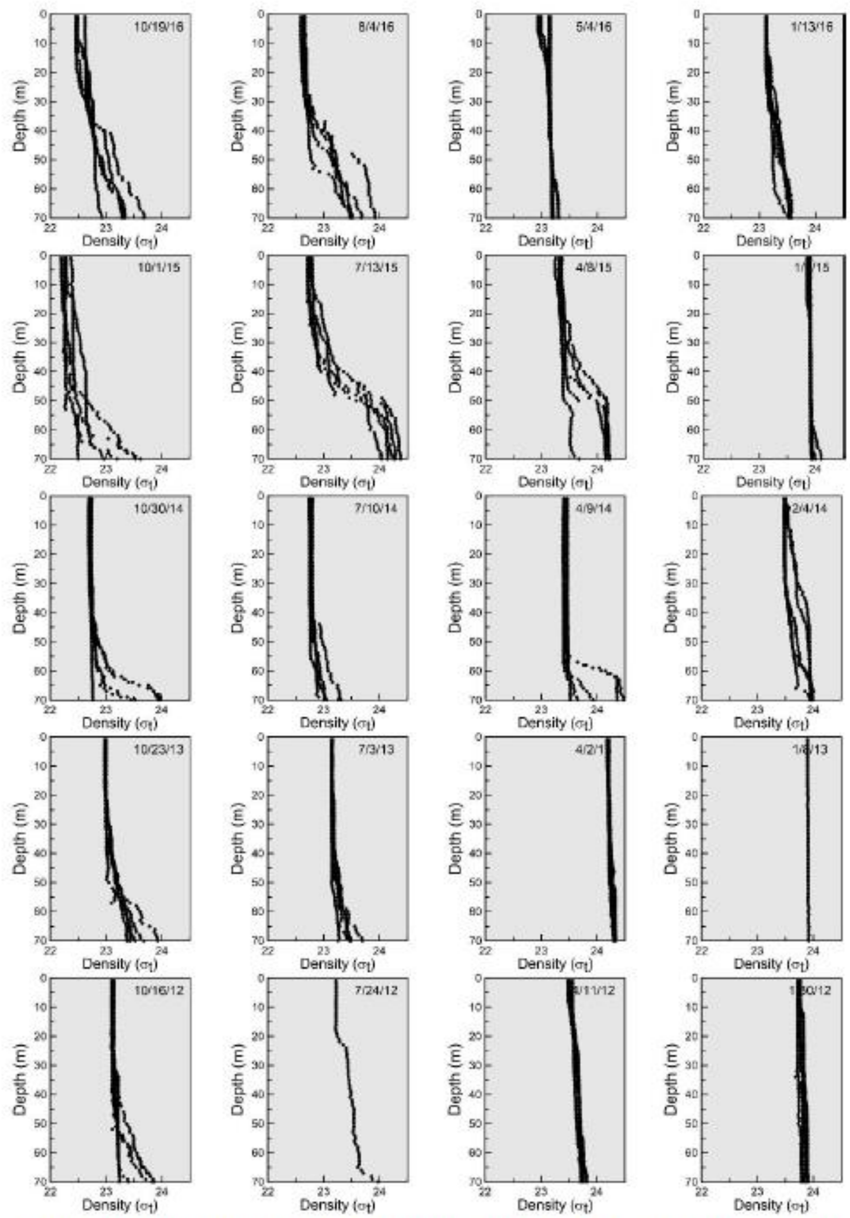


Figure 3-7. Representative quarterly density profiles measured near Sand Island ocean outfall, 2012 -2016. Stations E1 through E5.

## 3.5 Sand Island Wastewater Treatment Plant Flows

CCH staff measure and report effluent flows hourly at the SIWWTP. We reviewed the data and removed obvious spikes. Figure 3-8 presents the results plotted for the years 2012 through 2016 and a detail for the year 2016.

To obtain the peak 3-hour flow rate, we applied a moving average to the 2016 data and extracted the daily maxima. The peak value was assumed to be the 90% value (to avoid data spikes and wet weather events); this value was 86.2 mgd. The data from 2012 to 2016 show an average growth rate of about 2.2 mgd/year; so we extrapolated this trend to estimate future flows increasing by 11 mgd over the next five years (to 2021). Table 3-2 reports the flow rates used for this study.

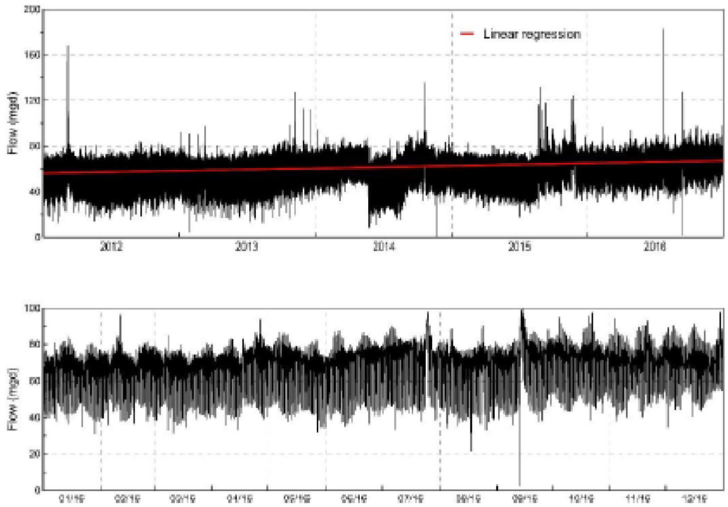



**Figure 3-8. Sand Island hourly WWTP flows 2012 - 2016 and 2016 detail.**

**Table 3-2. Sand Island Wastewater Treatment Plant Dry Weather Flow Characteristics**

| Parameter | Flow, mgd ($m^3/s$) | |
|---|---|---|
| | 2016 | Projected 2021 |
| Average | 67.1 (2.94) | 78.1 (3.42) |
| 3-hour peak | 86.2 (3.78) | 97.2 (4.26) |
| Design | 90.0 (3.94) | 90.0 (3.94) |

## 3.6 Effluent Density

The effluent density, in particular the density difference between the effluent and the receiving waters, affects dilution. For analyses presented in this TM we obtained effluent temperature and salinity data from CCH. CCH measured effluent temperatures daily from 1/1/2012 to 1/13/2015, and then approximately weekly until 12/31/2016. Eleven values of salinity were obtained from 2010 and 2012. Dilution decreases as the effluent density increases. For minimum dilution calculations, we assumed that the effluent salinity would be the 90th percentile value (7.1 psu) and the effluent temperature was the 10th percentile value (25.0ºC), leading to a computed effluent density of 2.4 $\sigma_t$ (1.0024 g/cm$^3$). For average dilutions, we assumed the average salinity (5.7 psu) and average temperature (26.7°C) for a computed effluent density of 1.0 $\sigma_t$. (1.0010 g/cm$^3$)

# Section 4: Dilution Simulations

## 4.1 Definitions of Dilution

We adopted the following dilution definitions for this TM:

- **Minimum Dilution at ZID (Critical dilution):** Ten percentile value of the dilutions computed at the projected 3-hour peak flow rate.
- **Average Dilution at ZID:** Geometric mean of the dilutions computed at the design flow rate.
- **Minimum Dilution at ZOM:** Ten-percentile value of the dilutions computed at the projected 3-hour peak flow rate. The calculations include far field diffusion but no bacterial decay.
- **Average Dilution at ZOM:** Geometric mean of the dilutions computed at the design flow rate. The calculations include far field diffusion but no bacterial decay.
- **Minimum Dilution at ZOM:** Ten-percentile value of the dilutions computed at the projected 3-hour peak flow rate. The calculations include far field diffusion and bacterial decay.
- **Average Dilution at ZOM:** Geometric mean of the dilutions computed at the design flow rate. The calculations include far field diffusion and bacterial decay.

## 4.2 Results

We ran NRFIELD using the profiles from the 10 offshore stations (Figure 3-6): D1 through D5 and E1 through E5, from 2012 to 2016. Excluding missing days, the data include 192 receiving water density profiles. Simulations were carried for the design and peak flows in Table 3-2 and the mid-current speed in each of the 10 frequency bins in Table 3-1, a total of 3,840 runs. The dilution results were weighted per the current speed distribution from Table 3-1 to account for the effect of currents on dilution and plume rise height. We report results for the whole water column and separately for plumes that rise into the upper 40 m of the water column. Table 4-1 summarizes the results.

**Table 4-1. Predicted Dilutions**

| Description | Notes | Dilution | |
|---|---|---|---|
| | | Whole water column | Upper 40 m of water column |
| Minimum dilution at ZID | Ten percentile value of dilution at peak flow | 221 | 624 |
| Average dilution at ZID | Geometric mean dilution at design flow | 550 | 943 |
| Minimum dilution at ZOM including far field diffusion but no bacterial decay | Ten percentile value of dilution at peak flow | 225 | 634 |
| Average dilution at ZOM including far field diffusion but no bacterial decay | Geometric mean dilution at design flow | 560 | 961 |
| Minimum dilution at ZOM including far field diffusion and bacterial decay | Ten percentile value of dilution at peak flow | 247 | 711 |
| Average dilution at ZOM including far field diffusion and bacterial decay | Geometric mean dilution at design flow | 616 | 1084 |

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## Appendix 2 Geosyntec Consultants Technical Memorandum dated October 3, 2017

Geosyntec consultants

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# Technical Memorandum

| | |
|---|---|
| Date: | 3 October 2017 |
| To: | City and County of Honolulu, Department of Environmental Services |
| From: | Stacey Isaac, Brandon Steets, PE, Geosyntec Consultants |
| Subject: | Sand Island Proposed WWTP NPDES Permit Limits: Enterococcus Daily Maximum Effluent Limitation Anti-degradation Evaluation<br>Geosyntec Project: LA0435 |

## INTRODUCTION

The Sand Island Wastewater Treatment Plant (WWTP), which is owned and operated by the City and County of Honolulu (City and County), has a National Pollutant Discharge Elimination System (NPDES) Permit (Permit No. HI 0020117) that allows the WWTP to discharge treated wastewater through an ocean outfall in Mamala Bay (Pacific Ocean). The NPDES Permit became effective on January 1, 2015 and will expire on November 11, 2019. The City is currently contesting certain NPDES Permit conditions, including the maximum daily effluent limitation for enterococcus.

The NPDES Permit includes limits for enterococcus, an indicator of fecal contamination and pathogens, for both the average monthly geometric mean and single sample maximum (SSM). This memorandum only addresses potential modification to the SSM limit. The City and County have asked Geosyntec Consultants to evaluate the anti-degradation implications of increasing the enterococcus daily SSM limit from 18,000 CFU/100 mL, which represents the maximum daily effluent limit established in the previous NPDES Permit, to 28,730 CFU/100 mL.

The State of Hawaii Department of Health (DOH) incorporated the federal anti-degradation policy into State regulations, which require that the existing high quality of waters be maintained unless degradation is justified. The level of water quality necessary to protect the existing designated beneficial uses must also be maintained and protected. Typically, an anti-degradation analysis may be needed to justify any potential degradation of existing water quality. However, if a proposed modification results in impacts below a threshold of significance, the activity may be deemed *de minimis* and not require an anti-degradation analysis. Guidance from the United States

Environmental Protection Agency (USEPA) (2005) recommended that "significant" lowering of water quality be defined by a projected lowering of water quality based on available assimilative capacity of a waterbody. The guidance also supported the use of ten percent (of available assimilative capacity) as the significance threshold. However, other significance thresholds as high as 33 percent have been used by other states and accepted by EPA[1]. Available assimilative capacity is defined here as the difference between existing pollutant concentrations in the receiving water and an applicable water quality criterion value, or the ability of a receiving water to assimilate additional pollutant loads from a discharger without exceeding water quality criteria.

Therefore, for the purposes of this analysis, it is assumed that there is no "significant impact" if an increase in discharge reduces available assimilative capacity by less than ten percent. If no significant impact is shown, further anti-degradation analysis is not required. This memorandum evaluates the potential impacts of the proposed NPDES Permit conditions for enterococcus.

In order to assess whether a significant impact to receiving water quality could result from the proposed increase in the enterococcus SSM limit, the assimilative capacity of Mamala Bay in the vicinity of the Sand Island outfall was evaluated. Dilution ratios observed in the receiving water were first computed using recent monitoring data from the receiving waters and effluent discharge from the WWTP. The assimilative capacity was then estimated based on the difference between the applicable water quality criteria and projected enterococcus concentrations in the receiving water under the previous permit limit and the proposed permit limit. The difference in the assimilative capacity between these two scenarios was evaluated relative to a ten percent threshold of significance.

## WATER QUALITY CRITERIA

All State waters are subject to recreational criteria established by the State of Hawaii DOH. DOH standards do not include SSM limits, but instead specify a monthly geometric mean limit of 35 CFU/100 mL and a statistical threshold value (STV) of 130 CFU/100 mL that cannot be exceeded

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[1] Includes the following significance thresholds: 33% (or one-third) of the assimilative capacity as specified by the Wisconsin Department of Natural Resources (Chapter NR 207.05); 20% of the available assimilative capacity as specified by the Arizona Department of Environmental Quality Water Quality Standards (Arizona Administrative Code Title 18, Chapter 11, Section 107.1); 15% of the difference in the baseline water quality and water quality standard as specified by the Colorado Department of Public Health and Environment Water Quality Control Commission Regulation 31.8(3)(c).

by more than ten percent of samples within a thirty day period. For purposes of this analysis, the STV limit of 130 CFU/100 mL was treated as a SSM limit.

The NPDES Permit includes requirements for offshore and nearshore receiving water monitoring. The State of Hawaii DOH water quality standards for enterococcus (including STV limit of 130 CFU/100 mL) are applicable. Nearshore receiving water stations include stations R1, R2, R3, C1A, C2A, C3A, C4, and C5A. Offshore monitoring is conducted at the following stations: D1, D2, D3A, D4, D5, E1, E2, E3, E4, and E5.

**DEVELOPMENT OF DILUTION RATIOS**

Monitoring data, from both the receiving water and the WWTP effluent, were used to calculate observed dilution ratios in the receiving water. Dilution ratios represent the ratio of the enterococcus concentration in the WWTP effluent to the concentration in the receiving waters.

The NPDES Permit establishes monitoring requirements for the receiving water. Nearshore and offshore samples are collected at three different depths: surface (within one meter below the surface), mid-depth, and bottom (within two meters above the bottom). Nearshore samples are collected seven times per month, and offshore samples are collected once per month, as specified by the NPDES Permit.

Observed dilution ratios were calculated for each day where both a receiving water[2] and WWTP effluent enterococcus sample were collected[3], for each receiving water station and depth required for monitoring in the NPDES Permit. The WWTP started using ultraviolet disinfection (UV) in November 2006. Therefore, in order for the analysis to be representative of current conditions and treatment mechanisms used by the WWTP, dilution ratios were calculated for available data starting in December 2006[4]. Observed average dilution ratios were then calculated for nearshore and offshore stations[5] separately (for each day with available data) and included all stations and

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[2] For receiving water results with a "<" or ">" qualifier, the reported values were used for purposes of calculating dilution ratios.

[3] WWTP effluent samples were collected daily.

[4] Through the end of 2016.

[5] Shoreline stations also were evaluated. However, based on information reviewed from the Krause Expert Report (2016) and experience on numerous urban shoreline bacteria source tracking investigations and beach predictive modeling studies, enterococcus levels detected at the shoreline stations are believed to be controlled by local, land-

depths required for monitoring in the NPDES Permit. Figure 1 shows the variability in these average dilution ratios over time, for the offshore and nearshore receiving water stations, with shoreline data excluded.

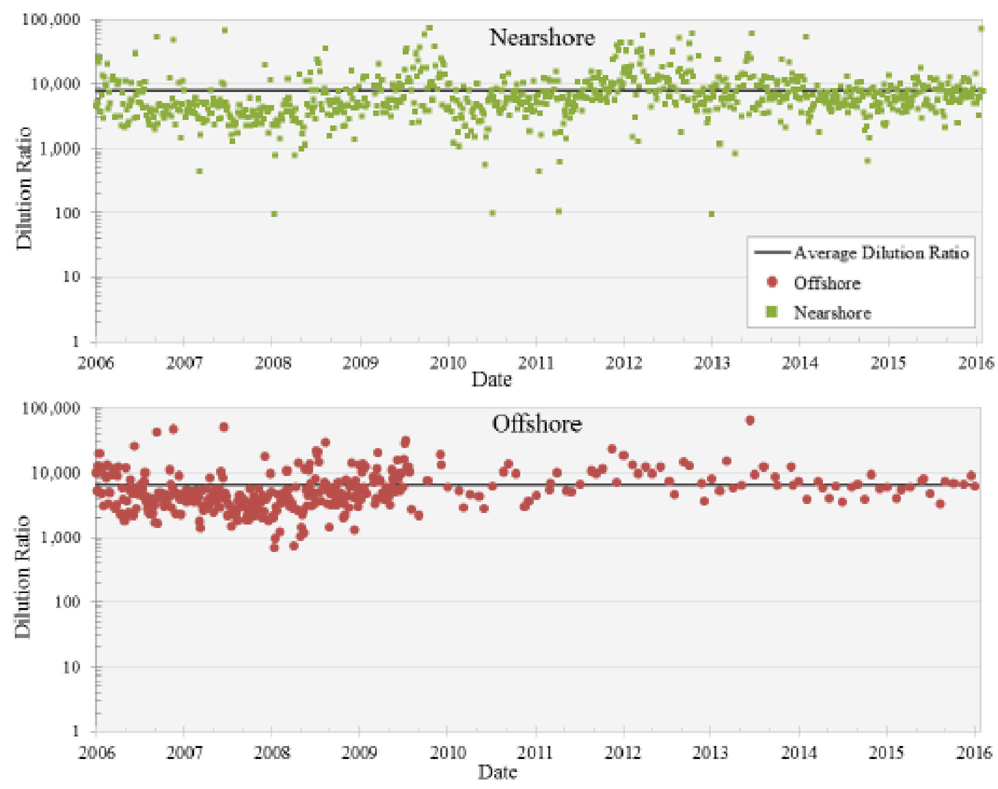


**Figure 1. Dilution Ratio Variability (Dec 2006 – 2016)**

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based sources (e.g., urban stormdrain outfalls/stormwater runoff, freshwater outlets, beach sources). Therefore, shoreline receiving water station data were not included in the dilution ratio analysis.

## RESULTS

Once average dilution ratios were computed for the nearshore and offshore receiving water stations, these ratios were used with the previous and proposed WWTP effluent permit limits to compute anticipated enterococcus concentrations in the receiving water (if effluent concentrations were to reflect the previous and proposed permit limit). The WWTP effluent concentrations were assumed to be equal to the previous NPDES Permit limit of 18,000 CFU/100 mL and the proposed limit of 28,730 CFU/100 mL.

The assimilative capacity of the receiving water was then estimated as the difference between the applicable water quality standard and the expected concentration in the receiving water. The assimilative capacity was estimated assuming both the previous and proposed enterococcus permit limit as the WWTP effluent concentration, and the percent difference of these values was calculated. These results are shown in Table 1.

**Table 1. Difference in Assimilative Capacity for Enterococcus**

| Receiving Water Location | Average Dilution Ratio | Water Quality Standard (CFU/100 mL) | Expected Receiving Water Concentration (CFU/100 mL) | | Assimilative Capacity (CFU/100 mL) | | Percent Reduction |
|---|---|---|---|---|---|---|---|
| | | | Previous Permit Limit[1] | Proposed Permit Limit[1] | Previous Permit Limit[1] | Proposed Permit Limit[1] | |
| Nearshore[2] | 7,741 | 130 | 2.3 | 3.7 | 128 | 126 | 1.1% |
| Offshore[2] | 6,540 | 130 | 2.8 | 4.4 | 127 | 126 | 1.3% |

[1] Assumed to equal the WWTP effluent enterococcus concentration
[2] Includes samples collected at three different depths: surface, mid-depth, and bottom

The percent difference between the scenarios using the previous and proposed enterococcus limits, for all three receiving water location categories, are all below the ten percent threshold. The largest difference between the scenarios is at the offshore locations, with a 1.3 percent decrease in assimilative capacity. **Because the differences in assimilative capacity at the nearshore and offshore locations are well below the ten percent threshold of significance, the receiving water impact of the proposed permit limit for enterococcus is considered *de minimis*.**

The approximate dilution ratio that would result in a change in assimilative capacity equal to the ten percent significance threshold was also examined, for both the nearshore and offshore locations. For the nearshore receiving water locations, this dilution ratio was approximately equal to the 6th percentile dilution ratio observed[6] over the time period analyzed (meaning approximately 6% of receiving water sampling locations over days with available data had lower dilution ratios, which would exceed the ten percent assimilative capacity threshold). The dilution ratio that resulted in the ten percent threshold for the offshore stations was representative of the 5th percentile value, meaning approximately five percent of observed dilution ratios (at all receiving water stations and depths) would have resulted in a difference in assimilative capacity greater than ten percent.

The approximate dilution ratios associated with the ten percent reduction in assimilative capacity are illustrated in Figure 2[7] for the nearshore and offshore stations.

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[6] Considering dilution ratios at all receiving water stations and depths required to be monitored by the NPDES Permit for the specified receiving water location category.

[7] As previously noted (for Figure 1), the dilution ratios shown in Figure 2 represent the average daily (for days with available data) dilution ratios, including all stations and depths required for monitoring in the NPDES Permit.

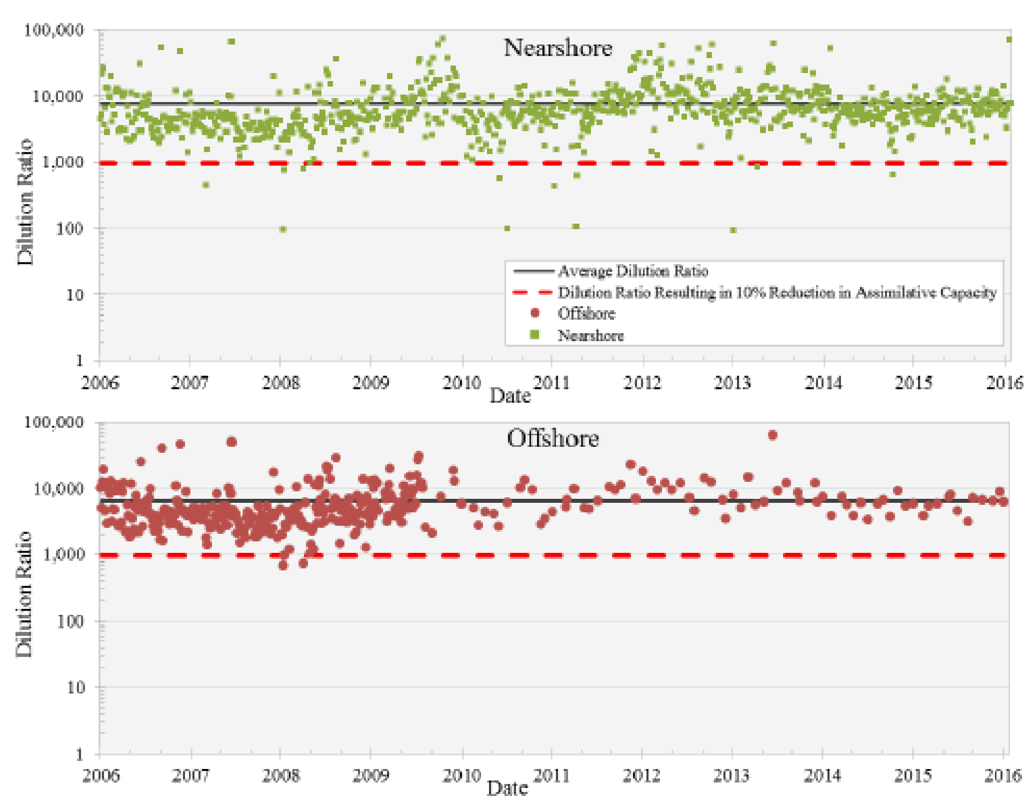


**Figure 2. Dilution Ratios Associated with Ten Percent Threshold**

These results show that, for the vast majority of days in the time period analyzed, the reduction in assimilative capacity between the previous and proposed enterococcus permit limits is less than ten percent at the nearshore and offshore receiving water locations. There are some low probability occurrences that could result in a change in assimilative capacity greater than ten percent[8],

[8] Moreover, this assumes that the WWTP discharges alone control these receiving water concentrations of enterococcus. We would expect nearshore dilution ratios to be higher than offshore dilution ratios due to the greater distance from the outfall. While this pattern is indeed borne out by the average dilution ratios (as shown in Table 1), it is less evident in the data points shown in Figure 2, where there were more low dilution ratios observed at the

however, this condition, should it occur, would be temporary and sufficiently infrequent that it would not alter the conclusion that the proposed permit limit is considered to have an insignificant impact on receiving water quality.

Moreover, receiving water enterococcus levels are expected to be most impacted by the WWTP discharge near the outfall location, within the zone of mixing, in the bottom depths. As a result, the receiving water stations closest to the outfall were further examined. The outfall (Outfall Serial No. 001) is an 84-inch diameter deep ocean outfall that discharges the treated effluent through a diffuser[9] approximately 9,100 feet offshore and 230 feet below the water surface. The analysis previously described was repeated using monitoring data from the receiving water locations closest to the outfall, which were assumed to be the bottom depth of the D2, E2, E3, and D3A stations. The results are shown in Table 2.

**Table 2. Difference in Assimilative Capacity for Enterococcus at the Most Impacted Receiving Water Locations**

| Receiving Water Location | Average Dilution Ratio | Water Quality Standard (CFU/100 mL) | Expected Receiving Water Concentration (CFU/100 mL) | | Assimilative Capacity (CFU/100 mL) | | Percent Reduction |
|---|---|---|---|---|---|---|---|
| | | | Previous Permit Limit[1] | Proposed Permit Limit[1] | Previous Permit Limit[1] | Proposed Permit Limit[1] | |
| Nearest Outfall[2] | 5,367 | 130 | 3.4 | 5.4 | 127 | 125 | 1.6% |

[1] Assumed to equal the WWTP effluent enterococcus concentration
[2] Stations D2, E2, E3, and D3A (bottom depths only)

The percent difference in assimilative capacity for receiving water monitoring locations closest to the outfall is significantly below the ten percent threshold, confirming the conclusion that the proposed permit limit is considered to have a *de minimis* impact on receiving water quality.

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nearshore locations compared to the offshore locations. These occasional lower dilution ratios at the nearshore locations are expected to be influenced by the many significant land-based shoreline sources of fecal indicator bacteria.

[9] The diffuser is approximately 3,400 feet long with side ports ranging in diameter from 3 inches to 3.53 inches and two ports at the end gate 7 inches in diameter.

**CONCLUSION**

In summary, because the reduction in assimilative capacity is below the ten percent significance threshold across the nearshore and offshore locations on average (and approximately 95% of the time at all nearshore and offshore receiving water stations and depths observed), and at the nearest receiving water monitoring locations to the outfall (bottom depth stations), the proposed permit limit is considered to have a *de minimis* impact on receiving water quality for enterococcus.

* * * * *

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